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Essays on the Definition, Measurement and Spatial Distribution of Creative Industries and Creative Employment in Portugal

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Tese de Doutoramento em Economia

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Biographical Note

Sara Cristina Santos Cruz was born on 23 May, 1978, in Coimbra, Portugal. In 2001, she concluded her degree in Economics at the Faculty of Economics of the University of Coimbra, Portugal. In 2002, she was awarded, together with the 120 best national young graduates in economics and management, the prize of High Potential Young Graduates of SONAE group, Portugal.

From 2002 to 2007, she performed a management career in two creative leading groups - L'Oréal Portugal (as brand manager; department of marketing); and the publishing group Porto Editora (as sub-director of department).

After the enriching passage through the world of management, the deep interest in the academic field called for the return to studies, and in 2008, she completed her Master degree in Economics of Development, on the topic of Industrial location - Industrial clusters, at the School of Economics and Management, University of Porto, Portugal.

From 2007 to 2011, she was researcher at the Center for Economics and Finance (Cef.Up), School of Economics and Management, University of Porto, within the scope of an international research project entitled as "Resources, Rights and Capabilities - in search of social foundations for Europe", where she had opportunity to develop work on the textile industries and workers of the Ave Valley, northern Portugal, in the fields of labour and regional economics.

From 2011 to date, she has been committed to the Foundation for Science and Technology, Ministry of Education and Science, as a doctoral student/ researcher in Regional Economics (School of Economics and Management, University of Porto, Portugal), having developed research on the industrial location and spatial distribution of creative industries and creative employment in Portugal.

During her master and doctoral programs, she published articles in co-authorship with Aurora Teixeira, in the international journals *Regional Studies*, *European Planning Studies* and *Annals of Regional Science*, and has also been referee of the journals *Environment and Planning C*, *European Planning Studies* and *The Professional Geographer/ Association of American Geographers*.

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Abstract

Over the past decade, the academic and political debate on industrial location has gradually come to highlight the geography of knowledge-intensive and creative activities as drivers of regional growth. Following the original UK government's report on the mapping of creative industries in 1998, and Richard Florida's study on the 'creative class' in 2002, a considerable amount of case studies on creative clusters, cultural quarters and creative cities has been put forward in several regions of the developed world.

Within the empirics of location, there has been an increasing interest in the analysis of the spatial distribution of creative industries and their importance in urban growth. These industries have a tendency to co-locate and their uneven spatial patterns are explained by territorial factors or location determinants. Despite all the novelties, so far, literature has hardly achieved common agreement on what defines and constitutes the Creative economy.

In this context, the present Doctoral thesis - *Essay 1* and *Essay 2* - is first dedicated to the systematization of the growing corpus of literature on creative industries and creative occupations, by providing a thorough survey in terms of existing definitions and taxonomies. Here, it is undertaken an extensive literature review related with the different methodological approaches on the measurement of the Creative economy, both in terms of creative industry sectors and of creative occupations.

Then, in *Essay 3*, it is developed a measurement approach that properly defines the Creative economy in Portugal, involving both creative industries (industry sectors) and creative occupations (employment). The data and information provided by that measurement approach and extracted from the Linked Employer-Employee databases (*Gabinete de Estratégia e Estudos*, Ministry of Economy of Portugal), allows an exploratory analysis of the geographical patterns of creative industries and creative employment in all the 308 municipalities of Portugal, using the software of spatial analysis ArcGIS 10.1 ®.

Finally, in order to understand the reasons why creative industries locate in particular regions, in *Essay 4*, it is carried out the analysis of these firms' location determinants, in all the Portuguese municipalities, using a recent Discrete Choice Model approach on the modelling of their location behaviour.

Resumo

Ao longo da última década, o debate académico e político sobre localização industrial tem vindo gradualmente a destacar a geografia das atividades criativas e baseadas no conhecimento como motores de crescimento regional. Na sequência do relatório governamental do Reino Unido sobre o mapeamento das indústrias criativas, em 1998, e do estudo de Richard Florida sobre a 'classe criativa', em 2002, uma quantidade considerável de estudos sobre *clusters* criativos, bairros culturais e cidades criativas tem sido apresentada em várias regiões do mundo desenvolvido.

Na literatura empírica sobre localização, tem havido um interesse crescente na análise da distribuição espacial das indústrias criativas e da sua importância no crescimento urbano. Essas indústrias revelam tendência a concentrarem-se geograficamente e os seus padrões de distribuição irregulares são explicados por fatores territoriais ou determinantes de localização. Apesar de todos os desenvolvimentos até à data, a literatura dificilmente tem alcançado consenso sobre o que define e constitui a Economia Criativa. Neste contexto, a presente tese de Doutoramento - *Essay 1* e *Essay 2* - é primeiramente dedicada à sistematização do crescente *corpus* de literatura sobre indústrias e ocupações criativas, fornecendo um estudo aprofundado em termos de definições e taxonomias existentes. Aqui, é realizada uma extensa revisão da literatura relacionada com as diferentes abordagens metodológicas sobre a mensuração da economia criativa, tanto em termos de setores industriais criativos como de ocupações criativas. Em seguida, no *Essay 3*, é desenvolvida uma metodologia de mensuração com vista a definir apropriadamente a economia criativa em Portugal, envolvendo tanto as indústrias criativas (setores industriais) como as ocupações criativas (emprego). Com base nessa metodologia e nos dados extraídos dos *Quadros de Pessoal* (Gabinete de Estratégia e Estudos, Ministério da Economia, Portugal), é levada a cabo uma análise exploratória dos padrões geográficos das indústrias criativas e do emprego criativo nos 308 concelhos de Portugal, utilizando o software de análise espacial ArcGIS 10.1 ®.

Finalmente, a fim de compreender as razões pelas quais as indústrias criativas se localizam em regiões específicas, no *Essay 4*, é levado a cabo o estudo dos determinantes de localização dessas empresas, utilizando uma recente abordagem com base nos Modelos de Escolha Discreta para modelizar o seu comportamento de localização.

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ESSAY 1

The magnitude of creative industries in Portugal: what do the distinct industry-based approaches tell us?

The magnitude of creative industries in Portugal: what do the distinct industry-based approaches tell us?[*]

Abstract

Despite the progress at theoretical and empirical levels, there is a generalized lack of clear definitions and estimations as to what represents cultural activities and creative industries. This paper critically reviews the growing corpus of literature on approaches to the measurement of creative industries and presents a detailed mapping of the creative sectors according to relevant industry-based methodologies. Using an official database - Matched Employer-Employee Dataset, which includes over 3 million workers, we found that, for Portugal, depending on the approach used, the importance of creative industries differs considerably, ranging from 2.5% (DCMS Model) to 4.6% (WIPO copyright model). We propose a distinct industry-based approach focusing on core creative industries. Accordingly, core creative industries represent 3.5% of Portuguese employment, in which 'Software publishing and Computer consultancy' (1.0%), 'Publishing' (1.0%), and 'Advertising and Marketing' (0.4%) are the most relevant sub-segments.

Keywords: Creative Industries; Industry-based Methodology; Measurement.

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1. Introduction

The rising political interest in the creative economy has led several experts (e.g., Hall, 2000; Scott, 2003; Landry, 2003; Thorsby, 2008a; Storper and Scott, 2009) to study the effects of creative industries and cultural activities on the development of a region or a country.

The literature in the field of creative and cultural economics is relatively recent and has been developed around two alternative research paths (Markusen *et al.*, 2008): one centred on *places* (e.g., Landry, 2003; Scott, 2003) and the other on *industries* (e.g., UNCTAD, 2004, 2008; KEA, 2006; Higgs *et al.*, 2008). Within the perspective of the *creative city*, academics and decision-makers have sustained the idea of developing cultural amenities for the regeneration of urban centres (Bianchini *et al.*, 1988; Landry, 2003), assuming that environments characterized by diversity, tolerance and openness contribute to the generation and diffusion of new ideas and innovations. The *industry* perspective (e.g., Power, 2002; Cunningham, 2004; Oakley, 2004; Pratt, 2004; DCMS, 2010, 2011) departs from the premise that creative and cultural industries have a particular role as drivers of local and regional development.

New theoretical approaches based on the above-mentioned perspectives, put forward by Florida (2002, 2005a, b) and Scott (2003), brought novel concepts such as the creative class and the cultural economy of urban centres. Complementarily, empirical approaches in the measurement of the creative economy have been developed (e.g., Higgs *et al.*, 2008; UNCTAD, 2008; DCMS, 2010), gathering data on creative industries and creative occupations (see Markusen *et al.*, 2008).

Despite all the novelties and progress, the 'original sin' intractably remains - the vagueness or even lack of clarification regarding the definition and estimation of creative industries and cultural activities (Markusen *et al.*, 2008; Pratt *et al.*, 2009). Indeed, several authors frequently use the expressions 'creative industries' and 'cultural activities' synonymously, overlooking their conceptual idiosyncrasies and contributing to the spread of imprecision and ambiguity, both at theoretical and empirical levels (Markusen *et al.*, 2008; UNCTAD, 2008). So far, the literature has barely come to agreement on what comprises the concepts of creative and cultural economics, as well as their precise boundaries and extent.

This paper intends to critically review the growing corpus of literature on the measurement of creative industries, namely their existing definitions and taxonomies. Additionally, it critically assesses each industry-based methodology by estimating the weight of core creative industries, based on an official dataset of Portugal, *Quadros de Pessoal*/ Matched Employer-Employee Datasets, for the year 2009 (the latest data available at the time of this study). Apart from serving as the basis to adequately compare the distinct methodologies to estimate creative industries, this exercise adds to the literature by providing empirical evidence on the weight of creative industries in a middle developed European country (Portugal).

In the next section, we review the existing methodological approaches that aim to group and quantify the creative industries. In Section 3, we present the main methodological considerations on the mapping of the industry-based methodologies using International Standard Industrial Codes (ISIC) and the Portuguese industrial classification. In Section 4, we estimate the dimension of creative industries in Portugal for the year 2009, in terms of creative industries' employment, for each methodological approach. In Section 5, major conclusions are presented.

2. Approaches to the measurement of Cultural and Creative industries: a brief review

Despite the rich contributions already put forward to define creative industries, it is hard to find agreement on the appropriate boundaries of the creative economy and what kind of industries should or not be included in this concept (Tepper, 2002; Jones *et al.*, 2004).

Four popular models, among others, are extensively discussed in literature (UNCTAD, 2004, 2008; Thorsby, 2008a): the *DCMS* framework, the *WIPO copyright* model, the *Symbolic Cultural* model and the *Concentric Circles* model, each one distinguishing between *core* and *peripheral* industries (cf. Table 1.1). Besides these, renowned authors in cultural economics, most notably Scott (2004) and Heng *et al.* (2003), proposed a different approach, where creative industries are differentiated according to their branches of activity: *production functions* (local networks of creative industries) vs. *distribution activities* (multinational/ global distribution networks) in the creative economy.

Similarly, UNCTAD (2004, 2008) organizes the creative sector in terms of "upstream activities" (cultural activities in strict sense, such as the performing and visual arts), and "downstream" market-driven industries (e.g., advertising, publishing or media related activities). Under this approach, cultural activities represent a segment of the entire universe of creative industries.

From all the frameworks presented, it is possible to draw distinct approaches according to each template's characteristics and rationale: i) *Economic/ Industrial approach* (e.g., DCMS template; WIPO Copyright model), based on the fact that creative industries use creativity as an input and protect their output with copyright/ intellectual property rights, earning profits therefrom; ii) *Cultural Content perspective* (e.g., Symbolic Model; Concentric Circles Model), stressing the intrinsic value of culture and popular arts as the major argument to group creative industries; and iii) *Upstream-Downstream branches of activity approach* (e.g., Heng *et al.*, 2003; Scott, 2004; UNCTAD, 2008), distinguishing between upstream and downstream industries in the creative economy.

It is clear from Table 1.1 that the extent of the creative sector is vast and diversified, comprising a range of industries that goes from purely aesthetic or cultural fields (e.g., visual and performing arts, cultural heritage) to highly knowledge-intensive segments (e.g., digital, technological, service-based activities), most of them revealing strong interdependencies among each other (UNCTAD, 2008). Moreover, all the approaches seem quite arbitrary and subjective in their selection and listing of industries. Each model posits arbitrarily different valuations in terms of core and peripheral, included or excluded industries, according to their interpretation of creative industries.

Each template has distinctive characteristics which reveal advantages but also limitations (see a synthesis in Table 1.2). Under the Economic/ Industrial approach, creative industries are the set of cultural and copyright industries that use creativity in their production process and generate output protected by intellectual rights (DCMS, 1998, 2001). In this perspective, the *DCMS model* presents advantages as a supporting template for policy-making and governmental decision. However, the arbitrariness of its "eclectic list" (Cunningham, 2002: 54) and the lack of compatibility with available classification systems (Higgs and Cunningham, 2008), impose some limitations to the measurement of the creative economy.

The *WIPO Copyright model* focuses on intellectual property/ copyright as a representation of the creativity incorporated in goods (WIPO, 2003). This involves industries directly or indirectly related with the creation, manufacturing/ production, broadcasting and distribution of copyrighted goods. An additional set of "interdependent" and "partial copyright industries" includes activities where intellectual property does not play a major role in their production processes. In this context, creative industries are directly entailed in the intellectual property of their output. The broad criteria of the WIPO model are not free from critiques. In this line of reasoning, not only cultural and creative activities reliant on copyright, but all the industries that create or commercialize patents/ intellectual rights should have to be included (e.g., "pharmaceuticals, electronics, engineering, chemicals") (Hesmondhalg, 2008: 560). One advantage of this model is that it takes into account the linkages between the digital economy (ICTs) and the diffusion of cultural/ creative outputs which have wide effects on the creative economy. Major drawbacks stem from difficulties in assessing such impacts, which have proved to be hard to estimate or preview (Handke, 2006), and in quantifying the creative economy, given the wide-ranging extent of sectors considered as creative industries, i.e., all the industries that are based on copyright (Thorsby, 2008a). Another major limitation resides in the assessment of the copyright factor[†] associated with each partial and interdependent copyright industry in this approach (WIPO, 2003; Chow and Leo, 2005).

[†] The copyright factor (or weighting) is "the percentage indicating the portion of a particular activity/industry that can be attributed to copyright-based activities" (WIPO, 2003: 85).

Table 1. 1: Mapping creative industries – industry-based approaches and respective templates

	Economic/ Industrial approach		Cultural Content approach		Upstream-Downstream Branches of Activity approach	
INDUSTRIES	**DCMS (UK)***	**WIPO Copyright**	**Symbolic Model**	**Concentric Circles Model**	**Heng *et al.* (2003), Scott (2004)**	**UNCTAD (2004)**
Performing Arts	Core	Core		Core	Production Activities	Arts
Visual Arts/Graphic Arts	Core					
Music	Core					
Musical Instruments		Interdependent				
Literature				Core		
Arts & Antiques Market	Core					
Heritage				Wider cultural		Heritage
Museums/Galleries				Other core		
Creative Arts			Peripheral		Production Activities (local dense networks)	
Architecture	Core	Partial		Related		
Fashion	Core		Borderline			
Design	Core					Functional creations
Crafts	Core					
Clothing/Footwear		Partial				
Photography	Core					
Film	Core	Core	Core	Other core	Distribution Activities (global networks of distribution)	Media
Video	Core			Wider cultural		
TV and Radio	Core					
Publishing	Core					
Advertising	Core			Related		New Media [functional creations]
Internet						
Software/Digital Contents	Core	Core	Borderline			
Computer Media	Core		Core	Wider cultural		
Collecting Societies		Core				
Sport			Borderline			
Recording (sound)		Interdependent		Wider cultural		
Paper						
Photocopiers/Photographic Equipment						
Consumer Electronics			Borderline			
Household Goods		Partial				
Toys						

Sources: UNCTAD (2008); DCMS (2010). We used different shades of grey, ranging from the darkest, indicating the core cultural and creative activities, to the lightest, indicating more peripheral cultural and creative activities.

Table 1. 2: Mapping Creative Industries - advantages and drawbacks of each industry-based approach in literature and in our mapping with international/ national industry codes

Approach	Model/ Template	Sectors considered/ Characteristics	Advantages	Disadvantages
Economic/ Industrial perspective *Focus on the level of creativity/ copyright component in final goods*	**DCMS Model** (DCMS, 1998, 2001, 2010)	Creative industries include 13 sectors: Advertising, Architecture, Arts and Antiques, Crafts, Design, Designer Fashion, Video, Film and Photography, Music and Visual & Performing Arts, Publishing, Software, Computer Games and Electronic Publishing, TV and Radio	✔ Simple to use and workable. ✔ Based on a supporting template for policy-making and governmental decision.	✖ Selection of a restrictive number of creative sectors. ✖ Arbitrary exclusion of certain activities from the listing (e.g., Heritage, Museum, Recreation). ✖ Difficulty in separating the creative from non-creative component of industry codes related with activities that are not entirely 'creative'. ✖ The Crafts sector cannot be captured by means of industry codes. ✖ Portions of codes taken – some degree of arbitrariness.
	WIPO copyright model (World Intellectual Property Organization, 2003)	Copyright-based industries are discriminated in terms of: - **Core Copyright**-based Industries - **Interdependent Copyright**-based Industries - **Partial Copyright**-based Industries	✔ More objective methodology on the selection of copyright-based activities, since criteria lie on copyright goods and intellectually protected contents.	✖ Set of broad and all-inclusive industry codes involving the wholesale, retail sale and rental activities. ✖ Difficult to assess the creative or copyright-based part of each of the industry code considered. ✖ Difficulties in obtaining an appropriate copyright factor for Interdependent and Partial copyright-based industries.
Cultural Content approach *Focus on Activities that produce culture/ creative content vs. Activities using creativity as input to diffuse it through distribution networks*	**Cultural Concentric circles model** (KEA European Affairs, 2006)	Creative and symbolic contents generated in the Core Cultural centre and transmitted through a succession of concentric circles. The four levels: i) **Core Cultural Centre** ii) **Layer 1**: Wider Core Cultural activities iii) **Layer 2**: Creative activities iv) **Layer 3**: Related Industries (ancillary services, equipment, supply services which facilitate the production and diffusion of cultural and creative contents).	✔ Emphasis on fine arts and on Cultural production. ✔ Importance of Fine Arts/ Culture as the epicentre of the creative economy. ✔ Representation with concentric layers, useful in policy analysis.	✖ Selection process reveals limitations: no consensus on defining / delimiting *cultural* and *creative* industries → no precise way of deciding which activities should be considered in the Cultural and those that should belong to the Creative sector. ✖ Mapping the Core of Cultural and Arts activities is strongly limited to the industry classification system, ✖ Some industry codes cannot be disaggregated into more detailed level → no way of separating production from distribution activities.
Branches of activity approach	**Upstream-Downstream activities approach** (Heng *et al.*, 2003; Scott, 2004; UNCTAD, 2004, 2008)	This approach distinguishes between: i) **Creation activities** Software production; Advertising production; TV& Radio; Publishing; Design; Architecture; Arts& Antiques Market; Performing, Visual arts & Music; Museums; Film & Video; Photography ii) **Distribution + Ancillary Activities** Software distribution; TV & Radio broadcasting; Publishing related services; Performing arts & Music distribution; Film & Video distribution; Photography related services	✔ Simple to use. ✔ Distinction between Creation/ Production activities and Distribution/ broadcasting activities. ✔ It facilitates the analysis of the interdependencies between creation and distribution activities.	✖ Limitations of industry classification codes in mapping either creation or distribution industries. ✖ Some industry codes, even at their maximum breakdown, include both creation and distribution activities → no way of separating production from distribution activities. ✖ Difficulties in quantifying linkages and interdependencies (e.g., spillovers, externalities, flows that surpass national borders) throughout the value-chain.

The Cultural Content approach includes both the *Symbolic model*, which envisages Fine Arts at the core of cultural and creative industries, and the *Concentric Circles model*, stressing that creative goods as symbolic contents (sound, text and image) are generated at the centre - core creative arts - and then transmitted through a succession of levels - concentric circles (Thorsby, 2008a,b; UNCTAD, 2008). A major feature of these templates, which can be considered as an advantage, is that they are reliant on a more narrow/ selective process of grouping creative industries, restricted to those that produce culture in a strict sense (Thorsby, 2008b). One critique of this perspective is that cultural/ creative contents can be resources and outcomes not only of purely cultural activities, but also of the entire creative economy (e.g., software, digital media, design, advertising). In this context, creative industries are considered as a broader arts economy (Potts, 2009).

The Branches of Activity (*Upstream-Downstream activities*) approach categorizes the creative economy in terms of "upstream activities", i.e., core cultural activities, and "downstream activities", i.e., commercial and distribution industries, dedicated to the diffusion and commercialization of cultural contents (e.g., Heng *et al.*, 2003; Scott, 2004; UNCTAD, 2008: 13). The strength of this perspective lies in the importance of tracing the linkages and interdependencies among all the industries that compose the value-chain, differentiating upstream from downstream segments (Scott, 2004). However, this advantage becomes a drawback when it comes to quantitatively measuring those interdependencies throughout the value-chain, such as dynamic spillovers, externalities and the flows that surpass national borders, as links are often established between local and transnational companies (Scott, 2004; Vang and Chaminade, 2007).

Whereas in *Cultural Concentric Circles* or in *Upstream-Downstream activities* approaches there is some consensus in distinguishing activities that produce culture/ creative contents (e.g., literature, music, design) from those which use creativity as an input and diffuse it through broadcast and distribution networks (e.g., advertising, publishing, film, video, TV, radio), in the *DCMS model* or in the *WIPO Copyright* perspective, the focus is instead on the level of creativity/ copyrighted component that is incorporated in goods as the main factor for distinguishing the creative core (Table 1.2).

3. Methodological considerations

Besides the intense debate surrounding the definition and delimitation of Creative Industries (CIs), estimations of their weight in the economy, usually in terms of employment, have been often performed using disparate and non-comparable datasets, involving information on distinct regions or countries, even when the same approach is used.

In order to have a more precise idea of the differences between the existing methodologies, it is necessary to depart from a single dataset and map all the proposals according to their industry-based approach, using a comparable scheme of industry classifications.

For this purpose, we undertook an extensive mapping of the approaches in literature – *DCMS model*; *WIPO template of copyright-based industries*; *Concentric Circles model*; *Upstream- Downstream activities model* – to measure the creative industries, as they were presented in Section 2. We used codes from the International Standard Industrial Classification of economic activities, ISIC (*Revision 3.1* and the latest *Revision 4*), and the corresponding codes for the Portuguese economic activities, based on the most recent industrial nomenclature (*Classificação das Actividades Económicas* - Revision 3, *CAE - Rev. 3*). In order to be as accurate as possible in this mapping and the respective estimation of all the approaches analyzed, we used detailed 5-digit industry codes, the maximum breakdown of Portuguese industry classification.[1] Then, estimations of the dimension of CIs were carried out, using each mapped industry-based approach. This empirical exercise allowed identifying the distinguishing features of each approach and taking accurate comparisons among them, departing from the same database.

To estimate the weight of creative industries as a percentage of national employment, we used data for Portugal, extracted from the *Matched Employer-Employee Databases* of GEE/ ME, *Gabinete de Estratégia e Estudos*, Ministry of Economy, Portugal. The data used is the latest available, from 2009, and covers all the industries and establishments operating in the national territory - mainland Portugal and Autonomous Regions - except for Public Administration servants and the self-employed. According to this dataset, the total employed population in 2009, in all the activity sectors, was

[1] In Tables A1.1-A1.5, the details of these mappings are presented.

3.128.126 workers. All the figures obtained for each 5-digit industrial code have been extracted using the software STATA®.[2]

All other methodological details and technical limitations of the data used are thoroughly described in Cruz and Teixeira (2013).

4. Estimating the weight of Portuguese creative industries

4.1. According to the main industry-based approaches in literature

Estimations according to each of the mapped methodologies were accomplished using a unique database, so that all the information could be properly compared. The data on Portugal was extracted from the official employment datasets for 2009, and the results are presented in Table 1.3.

Using the DCMS industry-based approach, it is estimated that Portuguese employment in the creative sectors (reference year 2009) accounts for approximately 2.5% of total national employment. As previously mentioned, this approach relies on a selective list of 13 creative sectors, inspired in the original DCMS methodology (cf. table A1.1). Furthermore, in cases where the sectors also comprised activities *outside* the creative economy (e.g., manufacturing activities), only a portion of the respective industrial code was considered, so as to capture only the creative activities. This perspective revealed to be restrictive both in the selecting process and when applying portions of industry codes to extract only the creative component. When analysing our data using the DCMS approach, the estimations led to very modest results. The estimate of 2.5% suggested that the use of such a selective approach on the creative core and the application of quite arbitrary portions of industrial codes could be underestimating the effective size of CIs in Portugal. We believe that this approach is more suited to the specific context of creative sectors in the country where it was first implemented (UK).

The WIPO copyright approach stands at the opposite extreme. This approach is developed by an international organization and the criteria applied appear to be more objective and broader than that of DCMS. The methodological issues can be easily

[2] The mapping exercise revealed to be a complex, time-consuming task, since a large number of empirical studies did not disclose their methodological procedures, taxonomy and their respective industry codes. Despite the suitable compatibility between ISIC - Rev. 4 and the Portuguese CAE - Rev. 3, the respective conversion was also a challenging task, since, in many cases, one ISIC code corresponded to several Portuguese 5-digit industry codes. In this case, to prevent ambiguity, the thorough interpretation of each creative sector's context and knowledge on the details of each ISIC and Portuguese CAE code revealed to be crucial.

adopted by any country with a set of developed rules on the protection of intellectual property and copyrights. The WIPO approach is reliant on a broader definition of CIs which is based on copyright-based industries (cf. table A1.2). When using the WIPO approach, our estimates led to a national employment share of 4.6% in Portuguese copyright-based industries – Core, Partial and Interdependent. The weight of Core Copyright-based industries was 3.9% of total employment. The relative weight of Interdependent Copyright-based industries in total employment was 0.3%; and the relative share of Partial Copyright-based industries was 0.4% (cf. Table 1.3).

One aspect stands out from the results obtained for the cases of Interdependent and Partial Copyright industries: their size in terms of relative weight in total employment appears confined to very modest values. These seemingly paradoxical results derive from the fact that although Portugal has a large number of workers in the apparel, textile and footwear industries, the proportion of those working in activities related with goods subject to copyright is very small. The copyright factors that were applied to Partial and Interdependent copyright industries, according to the WIPO methodology and to the available empirical studies, are thus responsible for the results obtained for those industries.

Despite the need of appropriate copyright factors to apply to the Interdependent and Partial Copyright-based industries in our country, when seeking to capture only those activities related with copyrighted goods (and which can only be obtained through extensive business surveys), the WIPO approach proved to be more objective on the calculation of the potential size of creative industries in Portugal.

Using the cultural approach of the Concentric Circles model (cf. Table A1.3), we obtained an estimate for the relative weight of Cultural and Creative industries in national employment of 3.7% (cf. Table 1.3). According to the methodology followed (KEA, 2006), the Core Cultural centre - composed by the fine arts and cultural/ artistic activities, such as ‘Visual arts’, ‘Performing arts’, ‘Photography’, ‘Heritage, museums and antique market’ activities - only represented 0.4% of total employment in Portugal. This is a modest result and should only be interpreted as indicative, since our industry nomenclature - *CAE - Rev. 3*, even at its maximum disaggregation of 5-digit codes, was not able to capture the majority of the activities involved in Culture and Fine Arts.

Table 1. 3: Estimating Creative Industries according to the existing industry-based approaches

Industry-based Approaches	Employment share of Creative Industries (relative weight in total economy employment)		
	Portugal (2009)		Studies from other countries using each methodology
DCMS Model	**Core Creative industries (13 sectors) 2.5%**		UK (2009): **4.99%;** UK (2010): **5.14%**[(a)]
			Scotland (2007): **3.0%**[(b)]
WIPO copyright model	**Creative industries -** Total Copyright-based Industries, where:	**4.6%**	Hungary (2002): **6.0%** Romania (2005): **3.7%** Bulgaria (2005): **4.3%** [(c)]
	▪ Core Copyright industries	**3.9%**	
	▪ Partial Copyright industries	**0.4%**	
	▪ Interdependent Copyright industries	**0.3%**	
Concentric circles model	**Total Cultural and Creative Industries** where	**3.7%**	Australia (2001): **3.6%** Canada (2001): **4.0%** New Zealand (2001): **4.1%** UK (2001): **7.5%** USA (2004): **3.8%** [(d)]
	▪ *Cultural Industries* [Core Centre (0.4%) + Wider Core Cultural (1.4%)]	**1.8%**	
	▪ *Cultural* and *Creative* Industries [Core Centre + Layer 1 + Layer 2]	**2.6%**	
	▪ *Cultural* Industries + *Creative* Industries + *Supporting related* Industries [Core Centre + Layer 1 + Layer 2 + Layer 3]	**3.7%**	
Upstream-Downstream branches of activity	**Creative industries** where:	**4.1%**	
	▪ Creation/ production activities	**2.3%**	
	▪ Distribution/ broadcasting activities	**1.8%**	

Notes: [(a)] DCMS (2011) does not take into account 'Software Consultancy' and 'Business and domestic software development': the estimates obtained reflect this fact; [(b)] Scottish Government Social Research (2009); [(c)] According to the figures presented in the WIPO reports (2005, 2008) and Tchalakov *et al.* (2007); [(d)]These figures were obtained using the Concentric Circles approach (Thorsby, 2008b: 155).

In fact, this limitation is transversal to all the industry classification systems and a weakness of all industry-based approaches in literature: the extreme difficulty in capturing and discriminating cultural and artistic activities. This conclusion is corroborated when we analyse the contribution of Wider Core Cultural activities (Layer 1), i.e., 'Film and video', 'TV and radio', 'Software and computer games publishing', 'Music' and 'Literature and press' in total employment, which amounted to almost 1.5% of the national workforce in 2009. This means that the industrial classification system in use, *CAE - Rev. 3*, revealed a greater ability to capture the activities that were included in the first layer of activities, in contrast to those in the Core cultural centre. Yet, similarly to the Core centre, difficulties in assessing Creative activities (Layer 2),

such as ‘Design and Fashion’, ‘Architecture and engineering’ and ‘Advertising’, arose when we used industrial codes and assumed portions to only capture the creative component of ‘Fashion design’ and of ‘Engineering services’, given the limitations of the industry classification system. The estimates obtained led to a relative weight of 0.8% in total Portuguese employment. At last, the vast category of industries supporting cultural and creative industries (Layer 3), which ranges from ancillary services to the supply of equipment and resource materials, including the ICT sector, represented 1.1% of total employment. Once more, better estimates obtained in this segment derived from the fact that the sectors here included had more-detailed descriptions in terms of the industrial nomenclature used.

Despite the relevance of the Concentric Circles Model and its cultural approach to creative industries, the extreme difficulty of industry classification codes to describe and assess artistic/ cultural activities imposes limitations to a fair measurement of cultural and creative industries in Portugal.

Finally, based on the Upstream-Downstream model of creative activities (cf. Table A1.4), the estimations suggest that all the industries involved both in Creation and Distribution activities contributed to 4.1% of national employment, with Creation and Production Industries accounting for 2.3% of total employment, and Distribution and Ancillary activities for 1.8% (cf. Table 1.3). Despite the relative simplicity of putting this approach into practice, difficulties arose when it was necessary to separate exclusively Creation activities from their associated Distribution/ Broadcasting activities, even when using detailed 5-digit industry codes. [3]

The methodologies detailed above to estimate the weight of creative industries, although providing useful information on a diversity of practical procedures, have proved to be limited in assessing the importance of CIs in Portugal (cf. Table 1.2). The DCMS approach is too selective and particularly designed to describe the creative economy of the UK. The WIPO approach reveals higher objectivity in the criteria used, but the industry categories of commercialization and supporting services are too broad; moreover, copyright factors applied to Partial and Interdependent Copyright industries are difficult to assess and have effects on the results obtained. The Cultural Concentric

[3] For instance, it was not possible to disaggregate Radio and Television production activities from their respective broadcasting services or to distinguish Photographic production activities from their related services.

Circles approach relies on cultural/ artistic activities at the core of the creative economy, which are barely captured by industry codes. The Upstream-Downstream activities model differentiates between Creation and Distribution activities, a task that is not always possible, given the limitations of the industry classification used. These arguments called for a more appropriate methodology to assess the weight of creative industries in the specific context of the country.

4.2. A proposal based on 'core' creative industries

The choice of a definition to select the industries to be included in the creative core with a suitable taxonomy for the available information, was subject to the following stages: i) to provide a definition/ concept of creative industries, with a primary interest in core creative industries; ii) to select and delimit creative industries based on the definition of core creative industries; iii) to consider the most objective methodology analysed as a point of departure; iv) to make the most of the proposed approach, given the industry classification system available (*CAE - Rev. 3*).

When mapping the existing industry-based approaches (cf. Tables A1.1-A1.4), a common aspect was that they considered in the core of creative industries all those dedicated to the production/ creation of creative goods. Thus, the key criterion to constitute the creative core was to include all the activities whose primary purpose is to produce creative goods. In addition, we also considered all those dedicated to the diffusion/ broadcasting/ reproduction services in straight correlation with production activities. In some cases, creation and distribution activities appear intertwined and cannot be disaggregated in their respective industry classification codes.[4] Concerning the taxonomy, we departed from an approach that revealed to be more objective than the others with regard to industry classification codes: the WIPO copyright model. Although our approach intends to analyse all the industries dedicated to creative goods, and not strictly focus on copyrighted goods, the relevance of using the WIPO approach is that the copyright criterion can be a more objective way of discriminating all the potentially creative goods, which is our main interest. Copyright is related with intellectual property rights and it generally covers "every production in the literary, scientific and artistic domain" as well as "ideas, processes, systems, operational

[4] For instance, 'TV and Radio', where production and broadcasting activities appear aggregated; 'Photographic activities' and 'Advertising', where creative outputs are simultaneously means of diffusion, appear aggregated.

methods, concepts, principles or discoveries" (WIPO, 2003: 14). Thus, in essence, all the creations likely to be protected by intellectual property rights are creative goods and fall under our definition of creative outputs. Having discriminated these goods, we were able to discriminate the creative industry sectors to be included in our approach hereafter.

We also considered *creativity* in its *broader* sense, which involves not only artistic and cultural creativity, but also scientific/ analytical creativity in the form of literary, academic, and scientific works. Thus, Research and Development (R&D) was included, as it is dedicated to the production of scientific creative contents. As pointed out by ground-breaking authors on the topic (e.g., Florida, 2002), creative activities should cover a wide range of sectors that includes not only the cultural and artistic industries, but also those dedicated to the production of analytic, technical and scientific knowledge, such as science, R&D, architecture, engineering and computing services. As well, the sectors related with heritage and leisure (Museums, Amusement and Recreation activities) were also taken into account.

Since the intention of our proposal was to capture all the activities primarily concerned to the production and creation of creative goods, activities such as wholesale, retail sale, rental services and other supporting industries related with transportation, equipment supply and distribution services, were excluded from the core. The vast sectors of Education, Business consultancy, Legal, Finance and Health services, and of the High-tech sector (IT hardware, telecommunications, robotics, optical and precision equipment, pharmaceuticals) were also excluded, since the main purpose is to analyse creative industries and not knowledge-based activities. In the same sense, the vast segments of Sports and Tourism activities were excluded, since their main purpose is not to exclusively produce creative goods or services.

Summing up, the main segments considered as *core creative sectors* in our approach were (cf. Table A1.5): i) Advertising and Marketing; ii) Architecture and Engineering; iii) Design and Fashion Design; iv) Crafts (e.g., 'pottery', 'hand-paint decoration', 'jewellery', 'woodcrafts', 'embroidery/ weaving'); v) Film, Video and Photography; vi) TV and Radio; vii) Music and the Performing Arts; viii) Publishing ('literature', 'press'

and 'library/ archive activities'); ix) Software Publishing and Computer consultancy, and x) Research & Development. [5]

Table 1. 4: Estimating Core Creative Industries in Portugal, 2009

Core Creative Industries	**ESTIMATIONS Portugal (2009)** – Employment in Core Creative Industries, as a percentage of total employment
ADVERTISING and MARKETING	**0.4%**
ARCHITECTURE and ENGINEERING	0.3%
DESIGN and FASHION Design	0.08%
CRAFTS	0.04%
FILM, VIDEO and PHOTOGRAPHY	0.2%
TV and RADIO	0.2%
MUSIC and the PERFORMING ARTS	0.2%
PUBLISHING	**1.0%**
SOFTWARE PUBLISHING and COMPUTER CONSULTANCY	**1.0 %**
RESEARCH & DEVELOPMENT (R&D)	0.1%
TOTAL Core Creative Sectors	**3.5 %**

Source: Own computation based on micro-data of the Matched Employer-Employee Databases, GEE/ME, Portugal (2009).

Using the proposed industry-based approach, the weight of creative industries represents 3.5% of Portugal's total workforce, that is, the core creative industries employed 109.343 workers in Portugal, in 2009.

The most relevant core creative sectors are (cf. Table 1.4): *Software publishing and Computer consultancy*, with a relative contribution of 1.0% to the national workforce; *Publishing*, with a relative weight of 1.0% in total employment; and *Advertising and Marketing*, with 0.4%.

Our estimations suggest that most important creative industries in Portugal mainly correspond to those which incorporate a larger number of technicians in supporting services to the creation/ production activities (e.g., software consultancy, publishing supporting services, advertising and marketing). Although these findings are reliant on the proposed definition for the creative core, the results reveal the importance of technical and assistance work in supporting the development of creative goods, within each sector considered.

[5] Even though we attempted to reduce as much as possible the cases in which only an assumed proportion of the industry code had to be considered, there was a need for this procedure, given the limitations of the industry classification system in use (e.g., 'Crafts', 'Design and Fashion Design', 'Architecture and Engineering').

5. Conclusions

The extent of the creative sector is vast and diversified, comprising a range of industries that goes from purely cultural fields (e.g., visual and performing arts, cultural heritage) to highly knowledge-intensive segments (e.g., media, digital, technological, consultancy activities). Literature has barely come to a common agreement on what constitutes and delimits creative and cultural activities. Indeed, these activities appear frequently intertwined in the creative economy. As Thorsby (2008b: 156) stated, "there is no "right" or "wrong" model" to analyse creative and cultural industries, but "simply a range of alternative constructions based on different sets of assumptions and employing different mechanisms for putting the parts together".

Despite the intense debate that surrounds the definition of creative industries, estimations of their weight in the economy are often made using disparate and non-comparable databases, involving information on distinct regions or countries.

Departing from a unique official dataset in order to adequately compare and estimate all the existing approaches, this study intended to contribute to the systematization of a growing corpus of literature related with measurement approaches to the creative industries. For this purpose, we accomplished a thorough review of the literature on the matter, which allowed us map some of the most important industry-based approaches to measure and quantify creative industries: DCMS taxonomy; WIPO methodology; Cultural Concentric Circles model; and the Upstream-Downstream activities model of creative industries. This extensive mapping was undertaken using the most recent International Standard Industrial Classification (ISIC) codes, at a 4-digit level, and the correspondent Portuguese industry codes (CAE) at 5-digits. This was the basis for the estimations undertaken on the creative industries, in terms of their respective employment in Portugal (data for 2009), according to each different industry-based approach in the literature.

Although providing useful information on a diversity of practical procedures, the approaches analysed reveal important drawbacks. The DCMS approach is too selective and particularly designed to describe the creative economy of the UK, from where it originated. The WIPO approach reveals higher objectivity in terms of the methodological criteria used, but its industrial categories related with commercialization, equipment or support services are too vast, and the copyright factors

applied to Partial and Interdependent Copyright industries are difficult to assess and have an impact on the results obtained. The Cultural Concentric Circles approach relies on cultural and artistic activities at the core of the creative economy, which can be barely captured when using industrial codes. The Upstream-Downstream activities model differentiates between Creation and Distribution activities, a task that is not always possible given the limitations of the industry codes used.

These arguments encouraged us to propose an industry-based methodology that could be better adapted to the empirical context of core creative industries in Portugal.

Using the proposed industry-based approach, our estimates showed that 109.343 employees were operating in all the sectors considered as core creative sectors in Portugal, in 2009. This represented 3.5% of the total Portuguese employment. This estimate is higher than that obtained using the DCMS approach (2.5%), which, in our perspective, constitutes a narrower perspective of the creative sectors. In turn, when compared with the estimates obtained using the WIPO approach (4.6%) or the Upstream-Downstream Industries model (4.1%), we find that the proposed approach led to a lower result (3.5%). This is due to the fact that the proposed definition is not as broad and all-inclusive as these approaches, which involve vast segments of distribution, commercialization and equipment supply not directly involved in the production of creative goods, in our perspective. If we look into the detail of the WIPO Core Copyright-based industries and that of the proposed template on core creative sectors, it is easy to conclude that differences in the estimates are explained by the fact that the WIPO approach includes the sectors of Wholesale, Retail sale, Rental services, and Telecommunications in their Core Copyright-based industries, which we excluded from our analysis. In turn, our proposed approach includes the relevant segments of Crafts, Design and Fashion design, Architecture and Engineering, Museums and Amusement activities in its core of creative industries.

This study clearly demonstrates that the results obtained are strongly dependent on the methodology followed. We believe that our proposed definition sums up all the relevant information on the core of creative industries according to all the existing industry-based approaches and to the context of the country analysed. Limitations of the industry classification systems in the appropriate description and measurement of creative activities are an aspect that is common to all the approaches here considered. Albeit the scope of this paper is to systematize industry-based approaches on the measurement of

creative industries, we acknowledge that this is also a limitation of this study. It appeals for the use of novel data sources, such as occupational data, or the combination of industry with occupational data, in order to extend the analysis to all the creative activities that operate outside the core of creative industries. Although recognizing this drawback, the mapping and comparison of each existing industry-based approach, departing from the same data source, and the proposal of a better suited taxonomy to the context of our country revealed to be a useful exercise in exploring new grounds on the systematization of this vast and puzzling literature.

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Annex 1

Table A1. 1: Mapping the DCMS industry-based model of Core Creative Industries, using ISIC and the correspondent Portuguese industry/ SIC codes

Core Creative Sectors	UK 2003 SIC codes	Proportion of code taken	ISIC codes – Rev. 4	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
1. Advertising	74.40	100%	7310; 7320	73110; 73120; 73200
2. Architecture	74.20	25%	7110; 7120	71110; 71120; 71200
3. Arts and Antiques	52.48/ 9; 52.50	5%	4774; 4791	47790
4. Crafts*	"Majority of businesses too small to be picked up in business surveys" (source: DCMS, 2010: 2)	-	-	23411; 23412; 23413; 23414; 23110; 23120; 23131; 23132; 23140; 23190; 16291; 16292; 32110; 32121; 32122; 32123; 32130
5. Design	"No codes match this sector" (source: DCMS, 2010: 2)	-	-	74100
6. Designer Fashion	17.71; 17.72; 18.10; 18.22; 18.23; 18.24; 18.30; 19.30	0.5%	1410; 1420; 1430; 1512; 1520;	14110; 14120; 14131; 14132; 14133; 14140; 14190; 14200; 14310; 14390; 15120; 15201; 15202
	74.87	2.5%	7410	74100
7. Video, Film & Photography	92.11; 92.12; 92.13; 22.32 74.81	100% 100% 25% 25%	5911; 5912; 5913 5914 1820 7420	59110; 59120; 59130 59140 18200 74200
9&10. Music and the Visual & Performing Arts	22.14; 22.31 92.31; 92.32; 92.34 92.72	25% 100% 25%	5920 9000; 7990 9321; 9329	59200 90010; 90020; 90030; 90040; 79900 9321; 9329
11. Publishing	22.11; 22.12; 22.13 22.15 92.40	100% 50% 100%	5811; 5813 5819 6391; 6399	58110; 58130; 58140 58190 63910; 63990
8&12. Software, Computer Games & Electronic Publishing	22.33 72.21 72.22	25% 100% 100%	1820 5820 6201; 6202	18200 58210; 58290 62010; 62020
13. Radio & TV	92.20	100%	6010; 6020	60100; 60200

Notes: The selection of codes and proportions taken was based on DCMS (2010) "Creative Industries Economic Estimates - 10 February 2010", available online at: https://www.gov.uk/government/publications/creative-industries-economic-estimates-february-2010 [accessed September 2014].

Correspondence Tables between ISIC - Rev. 3.1 and ISIC - Rev. 4 available at: http://unstats.un.org/unsd/cr/registry/regso.asp?Ci=60 [accessed September 2014].

The Portuguese nomenclature CAE Rev. 3 (*Classificação das Actividades Económicas*) has direct correspondence with ISIC - Rev. 4.

Codes eventually repeated in the mapping only were considered once in the estimations.

* It was considered here some industry codes of traditional manufacturing related with Crafts activities (ceramics; pottery; hand-painting decoration; glass; woodcrafts; jewelry); the proportion used was 5%.

Table A1. 2: Mapping the WIPO Copyright Model, using ISIC and the correspondent Portuguese industry/ SIC codes - CORE Copyright Industries

Sector	Description	ISIC codes – Rev. 3.1	Copyright factor associated	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
Literature Press	- Authors, writers, translators - Artistic and literary creation - Newspapers, magazines/ periodicals, books publishing - News agencies - Pre-press, printing, and post-press of books, magazines, newspapers - Wholesale and retail of press and literature - Libraries/ Archives	9214; 7499; 2212; 9220; 2221; 2219; 2222; 5139; 5239; 9231	**100%**	90030; 74300; 58110/20/30/40/90; 18110/20/30/40; 63910; 63990; 46492; 47610; 47620; 91011; 91012
Music, Theatrical Productions Operas	- Composers, lyricists, choreographers, directors - Artistic and literary creation - Publishing of music - Manufacturing of recorded music - Wholesale and retail of recorded music (sale and rental) - Agents/ ticket agencies	9214; 9219; 9249; 2213; 2230; 5233; 7130; 5139; 9214; 7414; 9214	**100%**	90010; 90020; 90030; 90040; 59200; 18200; 46430; 47630; 77220; 74900; 79900
Motion Picture and Video	- Directors, actors - Motion picture and video production and distribution - Motion picture exhibition - Video rentals and sales, video on demand - Ancillary services	9214; 9211; 9212; 7130; 2230	**100%**	59110/20/30/40; 77220; 18200
Radio and Television	- Radio and television broadcasting - Independent producers (not related with broadcasting) - Cable Television (systems and channels) - Satellite television - Ancillary services	9213; 7499; 6420; 9213	**100%**	60100; 60200; 61100; 61300
Photography	- Photographic Activities (Studios and commercial photography) - Photo Agencies and Libraries	7494; 2222; 7499; 9231	**100%**	74200; 74900;
Software and Databases	- Programming, development and design, manufacturing - Wholesale and retail pre-packaged software (business programs, video games, educational programs, etc.) - Database processing and publishing	7221; 7229; 5151; 5239; 7240; 7230	**100%**	58210; 58290; 62010/20/30/90; 46510; 47410; 63110; 63120
Visual and Graphic Arts	- Artists - Art galleries and other wholesale and retail - Picture framing and other allied services - Graphic design	9214; 7494; 9214; 7499	**100%**	90030; 47784; 74100
Advertising	- Agencies, buying services	7430; 7413	**100%**	73110; 73120; 73200
Copyright Collecting Societies	- Activities of professional organizations	9112	**100%**	94120

Source: World Intellectual Property Organization (WIPO) (2003), "Guide on Surveying the Economic Contribution of the Copyright-Based Industries".
Notes: The selection of codes and the copyright factor associated was based on the WIPO (2003).
Correspondence Tables between ISIC - Rev. 3.1 and ISIC - Rev. 4 available at: http://unstats.un.org/unsd/cr/registry/regso.asp?Ci=60 [accessed September 2014].
The Portuguese nomenclature CAE Rev.3 (*Classificação das Actividades Económicas*) is compatible with ISIC - Rev. 4. Codes eventually repeated in the mapping only were considered once in the estimations.

Table A1.2 (cont.): Mapping the WIPO Copyright Model, using ISIC and the correspondent Portuguese industry/ SIC codes - INTERDEPENDENT Copyright Industries

Sector	Description	ISIC codes – Rev. 3.1	Copyright factor associated *	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
TV sets, Radios, VCRs, CD players, DVD players, Cassette players, Electronic Game Equipment, and related	Manufacture of television and radio receivers, sound or video recording; Wholesale; Retail Sale; Renting of personal and household appliances	3230; 5139; 5233; 7130	**35%**	26400; 46430; 47430; 77220
Computers and Equipment	Manufacture of office/ accounting/ computing machinery; Wholesale of computers/ computer peripheral equipment/software; Renting of office machinery/ equipment (including computers)	3000; 5151; 7123	**35%**	26200; 46510; 47410; 77330
Musical Instruments	Manufacture of musical instruments; Wholesale; Retail Sale of household goods, articles and equipment	3692; 5139; 5233	**20%**	32200; 46494; 47593
Photographic and Cinematographic Equipment	Manufacture of optical instruments and photographic equipment; Wholesale; Retail Sale; Renting of other machinery and equipment	3320; 5139; 5239; 7129	**30%**	26702; 27400; 47782; 77390
Photocopiers	Manufacture of office, accounting and computing machinery; Wholesale; Retail Sale other machinery and equipment	3000; 5159	**30%**	28230; 46660; 47781; 77330
Blank Recording Material	Manufacture of other chemical products; Wholesale of electronic and telecommunications parts and equipment; Retail sale of household appliances, articles and equipment	2429; 5152; 5233	**25%**	20594; 26800; 46520; 47630
Paper	Manufacture of pulp, paper and paperboard; Wholesale of other intermediate products, waste and scrap; Other retail sale in specialized stores	2101; 2109; 5149; 5239	**25%**	17110; 17120; 17230; 46762; 47620

Notes: *Copyright factors not available for Portugal. The information was based on the WIPO (2003) guide, on the WIPO (2005, 2008) reports, on the report by Tchalakov et al. (2007) and on Chow and Leo (2005).
Codes eventually repeated in the mapping only were considered once in the estimations.

Table A1.2 (cont.): Mapping the WIPO Copyright Model, using ISIC and the correspondent Portuguese industry/ SIC codes - PARTIAL Copyright Industries

Sector	Description	ISIC codes – Rev. 3.1	Copyright factor associated*	Portuguese SIC codes - CAE - Rev. 3 – 5 digits
Apparel, textiles and footwear	Manufacture of wearing apparel; Manufacture of made-up textile articles; Manufacture of footwear; Wholesale of textiles, clothing and footwear; Retail sale of textiles, clothing, footwear and leather goods	1810; 1721; 5131; 5232; 1920; 5131; 5232	**0,5%**	14110; 14120; 14131/2/3; 14140; 14190; 14200; 14310; 14390; 15120; 13910; 13920; 13961; 13962; 13991; 13992; 13993; 46410; 47510; 15201; 15202; 46421/2; 47711/2; 47721/2
Jewellery and coins	Manufacture of jewellery and related goods; Wholesale of other household goods; Other retail sale in specialized stores	3691; 5139; 5239	**25%**	32110; 32121; 32122; 32130; 46480; 46494; 47770; 47784
Other Crafts	Activities of other membership organizations; Other retail sale in specialized stores	9199; 5239	**40%**	94991; 47784
Furniture	Manufacture of furniture; Wholesale of other household goods; Retail sale; Renting of personal and household goods	3610; 5139; 7130	**5%**	31010/20/30; 31091; 31092; 31093; 31094; 46470; 46650; 47591
Household goods, China and Glass	Manufacture of glass and glass products; Manufacture of knitted and crocheted fabrics and articles; Manufacture of other products of wood; Manufacture of other fabricated metal products; Wholesale of other household goods; Retail sale of household	2610; 173; 2029; 2899; 5139; 5233	**0,5%**	23110; 23120; 23131; 23132; 23140; 23190; 13920; 46410; 47510; 16291; 16292; 46494; 47593; 23411; 23412; 23413; 23414; 46441; 47592; 25710; 25991; 22292; 27510; 46430; 47540
Wall coverings and Carpets	Manufacture of carpets and rugs; Manufacture of other articles of paper and paperboard; Other retail sale in specialized stores	1722; 2109; 5239	**2%**	13930; 17240; 46470; 46732; 47530
Toys and Games	Manufacture of games and toys; Wholesale of other household goods; Other retail sale in specialized stores	3694; 5139; 5239	**40%**	32400; 46493; 47650
Architecture, Engineering, Surveying	Architectural and engineering activities and related technical consultancy	7421	**10%**	71110; 71120; 71200
Interior Design	Other business activities	7499	**-**	Already considered in Core Copyright Industries. The Portuguese industry code **74100 - Design activities** cannot be disaggregated into more detail.
Museums	Museums activities and preservation of historical sites and buildings	9232	**50%**	91020; 91030

Notes: * Copyright factors not available for Portugal. The information was based on the WIPO (2003) guide, on the WIPO (2005, 2008) reports, on the report by Tchalakov et al. (2007) and on Chow and Leo (2005).
Codes eventually repeated in the mapping only were considered once in the estimations.

Table A1. 3: Mapping the Cultural Concentric Circles Model, using ISIC and the correspondent Portuguese industry/ SIC codes - CORE Creative Centre – Cultural Fine Arts

Sector	Description	ISIC codes – Rev. 3.1	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
Visual Arts [crafts, painting, sculpture, photography]	**Crafts**: "ranges in most categories in manufacturing and retail" (KEA, 2006: 309)	No industry codes describing Crafts	*47784; 23411; 23412; 23413; 23414; 23110; 23120; 23131; 23132; 23140; 23190; 16291; 16292; 32110; 32121; 32122; 32123; 32130
	Paintings and Sculpture: Artistic and literary creation and interpretation; Operation of arts facilities and museums; Other business activities; Exhibition halls; Other retail sale in non-specialized stores; Other retail sale in specialized stores	9214; 7499; 7010; 5219; 5239	90030; 94120; 90040; 91020; 91030; 74900; 47784
	Photography: Photographic Activities	7494; 9220	74200; 63910; 63990
Performing Arts (including festivals)	**Theatre** Artistic and literary creation and interpretation	9214	90010; 90020
	Dance Artistic and literary creation and interpretation	9214	
	Circus Other entertainment activities	9219	
Heritage	**Museums activities** and preservation of historical sites and buildings	9232	91020; 91030
Museums and Libraries	**Library and Archives activities**	9231	91011; 91012
Arts & Antiques Market	**Arts and Antiques Market**	5240	47790

Source: KEA European Affairs (2006).

Notes: * Here, it was considered some industry codes of traditional manufacturing related with Crafts activities (ceramics; pottery; hand-painting decoration; glass; woodcrafts; jewelry); the proportion used was 5%.

Codes eventually repeated in the mapping only were considered once in the estimations.

Table A1.3 (cont.): Mapping the Cultural Concentric Circles Model, using ISIC and the correspondent Portuguese industry/ SIC codes

Layer 1 - WIDER Core Cultural Industries

Sector	Description	ISIC codes – Rev. 3.1	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
Film and Video	Production of films/ videos (including commercials, activities of studios); Distribution of videos and DVDs; Reproduction of recorded media; Exhibition/ Projection of movies; Wholesale of video tapes and DVDs; Retail sale of video tapes and DVDs; Video Sale through rental of videos and DVDs	9211; 2230; 9212; 5139; 5233; 7130	59110; 59120; 59130; 18200; 59140; 46430; 47630; 77220
Television and Radio	National radio and television broadcasting companies; Other radio and television broadcasters; Independent producers (not related with the broadcasting); Cable Television (systems and channels); Satellite Television	9213; 7499; 6420	60100; 60200; 61100; 61300
Software Publishing including Games	Development, production, supply and documentation of ready-made (non-customized) software, including games	7221	58210; 58290; 62010
Music	Artistic and literary creation and interpretation; Printing and publishing of music; Production/manufacturing of recorded music; Wholesale and retail of recorded music (sale and rental)	9214; 2213; 2230; 5139; 5233; 7130	90030; 59200; 18200; 46430; 47630; 77220
Literature and Press	Book publishing; Newspapers publishing; Magazines/periodicals; Wholesale and retail sale of press and literature (book stores, newsstands, etc.); Retail sale via mail order houses/ Internet	2211; 2212; 5139; 5239; 5251; 7240	58110; 58120; 58130; 58140; 58190; 46492; 47610; 47620; 47910

Source: KEA European Affairs (2006). *Notes:* Codes eventually repeated in the mapping only were considered once in the estimations.

Table A1.3 (cont.): Mapping the Cultural Concentric Circles Model, using ISIC and the correspondent Portuguese industry/ SIC codes

Layer 2 - CREATIVE Industries

Sector	Description	ISIC codes – Rev. 3.1	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
Design (including Fashion)	**Fashion Design** Manufacture of wearing apparel; Manufacture of textiles; Manufacture of footwear	1800; 1700; 1920	* 14110; 14120; 14131; 14132; 14133; 14140; 14190; 14200; 14310; 14390; 15120; 13910/20; 13961/2; 13991; 13992; 13993; 46410; 47510; 15201; 15202; 46421/2; 46160; 47711/2; 47721/2.
	Graphic and Product Design Printing; Ancillary activities related to printing; Other business activities (namely, Graphic Design)	2221; 2222; 7421; 7430; 7499; 9309; 9214	18110; 18120; 18130; 18140; 74100
	Interior Design Other business activities (namely, Graphic Design)	7499; 9309	74100
Architecture	Architectural and engineering activities and related technical consultancy	7421	71110; 71120; 71200
Advertising	Agencies, buying services	7430	73110; 73120; 73200

Source: KEA European Affairs (2006).
Notes: Codes eventually repeated in the mapping only were considered once in the estimations.
* Only a proportion of 0.5% was considered in these industry codes.

Table A1.3 (cont.): Mapping the Cultural Concentric Circles Model, using ISIC and the correspondent Portuguese industry/ SIC codes

Layer 3 - RELATED Industries (e.g., equipment, source materials, ancillary services)

Sector	Description	ISIC codes – Rev. 3.1	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
Computers/ ICT and Software manufacturing and distribution	Manufacture of office, accounting/ computing machinery; Wholesale of computers, computer peripheral equipment and software; Renting of office machinery/ equipment (including computers)	3000; 5151; 7123	26200; 46510; 47410; 77330
TV sets, Radios, MP3/ 4 players, CD players, DVD players, Cassette players, Electronic Game Equipment, and other similar equipment	Manufacture of television and radio receivers, sound/ video recording, reproducing apparatus and related; Wholesale; Retail Sale; Renting of personal and household appliances	3230; 5139; 5233; 7130	26400; 46430; 47430; 77220
Photographic and Cinematographic equipment and related services	Manufacture of optical instruments and photographic equipment; Wholesale; Retail sale of photographic/ cinematographic/ optic equipment/ chemicals specific to film processing; Renting of other machinery and equipment	3320; 5139; 5239; 7129	26702; 27400; 47782; 77390
Photocopiers	Manufacture of office, accounting and computing machinery; Wholesale; Retail Sale other machinery and equipment	3000; 5159	28230; 46660; 47781; 77330
Blank Recording Material	Manufacture of other chemical products; Wholesale of electronic, telecommunication components and equipment; Retail sale of household appliances and equipment	2429; 5152; 5233	20594; 26800; 46520; 47630

Source: KEA European Affairs (2006).
Notes: Codes eventually repeated in the mapping only were considered once in the estimations.

Table A1. 4: Mapping the Upstream-Downstream Activities Model, using ISIC and the correspondent Portuguese industry/ SIC codes

CREATION and PRODUCTION Activities

Sector	Description	ISIC codes – Rev. 3.1	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
IT and Software (including games) production	Development, production, supply and documentation of software, including games; Database processing and publishing	7221; 7229; 7240	58210; 58290; 62010; 62020; 63110
Advertising	Agencies, buying services	7430	73110; 73120; 73200
Broadcasting Media (TV, Radio)	Radio and television broadcasting companies	9213	60100; 60200
Publishing	Publishing of newspapers; Publishing of periodicals/ magazines; Publishing of books; Other publishing (e.g., photos, posters, postcards); News agencies activities	2212; 2211; 2219; 9220	58130; 58140; 58110; 58120; 58190; 63910; 63990
Interior, Graphics, Industrial and Fashion Design	Other business activities	7499	74100
Architectural Services	Architectural and engineering activities and related technical consultancy	7421	71110; 71120; 71200
Arts and Antiques Market/ Crafts	Other retail sale in specialized stores; Retail sale of second-hand goods in stores	5239; 5259; 5240	47790; 47784
Performing Arts and Music	Composers/ Lyricists/ Arrangers/ Choreographers/ Directors/ Performers; Printing and publishing of music; Artistic and literary creation and interpretation	9214; 9219; 9249; 2213	90010; 90020; 59200; 90030
Museums/ other cultural activities	Museums activities and preservation of historical sites and buildings	9232	91020; 91030
Motion Picture and Video	Motion picture and video production	9211	59110; 59120
Photography	Photographic Activities (Studios and commercial photography)	7494	74200

Sources: Heng *et al.* (2003); Scott (2004); UNCTAD (2004, 2008).
Notes: Codes eventually repeated in the mapping only were considered once in the estimations.

Table A1.4 (cont.): Mapping the Upstream-Downstream Activities Model, using ISIC and the correspondent Portuguese industry/ SIC codes

DISTRIBUTION and ANCILLARY Activities

Sector	Description	ISIC codes – Rev. 3.1	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
IT and Software (including games) distribution and related services	Internet services; Management and exploitation of software equipment; Reproduction of recorded media (namely, software, games); Wholesale and retail prepackaged software (business programs, video games, educational programs, etc.)	7230; 7229; 2230; 5151; 5239	63120; 62030; 62090; 18200; 46510; 47410
Broadcasting Media related services (Television, Radio)	Cable Television (systems and channels); Satellite Television; Broadcasting ancillary services	6420; 9213	61100; 61300
Publishing related services	Printing of newspapers; Books/ Magazines/periodicals; Pre-press, printing, and post-press services of books, magazines, newspapers, etc.; Manufacture of stationery paper/ computer printout paper/ printing and writing paper; Wholesale of bulk paper; Wholesale and retail of press and literature (book stores, newsstands, etc.); Libraries/ Archives	2221; 2222; 2109; 5149; 5139; 5239; 9231	18110; 18120; 18130; 18140; 17230; 46762; 46492; 47610; 47620; 91011; 91012
Performing Arts associated services	Performances and allied agencies (booking/ ticket agencies); Operation of concert and theatre halls and other arts facilities; Art Galleries	9214	79900; 90040; 47784
Music associated services	Production/manufacturing of recorded music; Wholesale and retail of recorded music (sale and rental)	2230; 5233; 7130; 5139	18200; 46430; 47630; 77220
Motion Picture and Video related services	Motion picture and video distribution; Motion picture exhibition; Video rentals and sales, video on demand; Reproduction of recorded videos	9211; 9212; 7130; 2230	59130; 59140; 77220; 18200
Photography related services	Photographic film processing; Photographic equipment wholesale/ retail sale/ renting; Photo Agencies	7494; 5139; 5239; 7129	74200; 47782; 77390

Sources: Heng *et al.* (2003); Scott (2004); UNCTAD (2004, 2008).
Notes: Codes eventually repeated in the mapping only were considered once in the estimations.

Table A1. 5: Mapping our proposed industry-based approach, using ISIC and the correspondent Portuguese industry/ SIC codes

Sector	Description	ISIC codes – Rev. 4	Portuguese SIC codes - CAE - Rev. 3 - 5 digits
Advertising and Marketing	Advertising agencies; Media representation; Market research and public opinion polling	7310 7320	73110; 73120; 73200
Architecture and Engineering	Architectural activities; Engineering activities and related technical consultancy services*; Technical testing and analysis*	7110 7120	71110 71120 [10% of the code]* 71200 [10% of the code]*
Design and Fashion Design	Specialized design activities; Textile manufacturing codes associated with Fashion Design [0.5% of the codes]**	7410 1410; 1511; 1512; 1520	74100 0.5% of the following codes**: 14110/20; 14131/2/3; 14140/90; 14200; 14310/90; 15120; 13910/20; 13961/2; 13991/2/3; 15201; 15202
Crafts	Majority of ISIC and Portuguese SIC codes refer to *Manufacturing activities* and are not appropriate to measure handcraft activities (e.g., pottery, ceramics, glass, woodcrafts/ basketry, embroidery/ weaving, jewelry). Even so, we tried to capture some of the most relevant activities in this sector, using a portion of 5% of the respective industry code***	2393; 2310; 1629; 3211; 3212	5% of the following codes***: 23411; 23412; 23413; 23414; 23110; 23120; 23131; 23132; 23140; 23190; 16291; 16292; 32110; 32121; 32122; 32123; 32130
Film, Video and Photography	Motion picture, video and television program production activities; Motion picture, video and television program post-production activities; Motion picture, video and television program distribution activities; Motion picture projection activities; Photographic activities	5911; 5912; 5913; 5914; 7420	59110; 59120; 59130; 59140; 74200
TV and Radio	Radio activities; Television activities	6010; 6020	60100; 60200
Music and the Performing Arts	Sound recording and music publishing activities; Reproduction of recorded media; Performing arts; Support activities to performing arts; Artistic and literary creation; Operation of arts facilities; Activities of amusement parks and theme parks; Other amusement and recreation activities	5920; 1820; 9000; 9321; 9329	59200; 18200; 90010; 90020; 90030; 90040; 93210; 93291; 93292; 93293; 93294
Publishing	Book publishing; Publishing of directories and mailing lists; Publishing of newspapers; Publishing of journals and periodicals; Other publishing activities; Translation and interpretation activities; Library/ Archives activities; Museums activities; Historical sites/ monuments/ botanical/ zoological gardens, aquariums/ natural parks activities; News agency activities; Printing and related activities (e.g., pre-press, bookbinding)	5811; 5812; 5813; 5819; 7490; 9101; 9102; 9103; 6391; 6399; 1811; 1812	58110; 58120; 58130; 58140; 58190; 74300; 91011; 91012; 91020; 91030; 91041; 91042; 63910; 63990; 18110; 18120; 18130; 18140
Software Publishing and Computer Consultancy	Publishing of computer games; Other software publishing; Computer programming activities; Computer consultancy activities; IT management activities; Other IT/ computer service activities; Data processing, hosting and related activities; Web portals	5820; 6201; 6202; 6209; 6311; 6312	58210; 58290; 62010; 62020; 62030; 62090; 63110; 63120
Research and Development	Research and development on natural sciences and engineering; Research and development on social sciences and humanities	7210; 7220	72110; 72190 72200

Notes: * We included 100% of the industry code of 'Architectural activities', but only an assumed portion of 10% on 'Engineering activities' and 'Technical testing and Analysis', based on indicative values drawing from literature. In this case, we use a value proximate to the average of copyright factors applied to these activities, in studies following the WIPO approach; ** The portion of 0.5% is based on indicative values drawing from the empirical literature. In this case, we use a value proximate to the average of copyright factors applied to these activities, in several studies using the WIPO approach; *** The portion of 5% was based on indicative values drawing from the empirical literature. Codes eventually repeated in this mapping only were considered once in the estimations.

ESSAY 2

Assessing the magnitude of Creative employment: A comprehensive mapping and estimation of existing methodologies

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Assessing the magnitude of Creative employment: A comprehensive mapping and estimation of existing methodologies[*]

Abstract

The present study surveys and maps the existing methodological approaches for measuring the creative employment. Based on a unique matched employer-employee dataset which encompasses over 3 million Portuguese workers, we found that the magnitude of the creative class varies considerably between approaches, ranging from 2.5%, using the conventional industry-based taxonomy and 30.8%, using Florida's occupational proposal. The disparities are justified on the basis of the departure definition of what creative employment is and from operationalization issues regarding which industries and occupations to be included. Interestingly, when we focus on 'core' creative employment, the figures conveyed by the distinct approaches are strikingly similar (around 6%) suggesting that, at least in what core creative employment is concerned, the distinct approaches converge. The diversity of approaches and measurements are not necessarily a bad thing in itself, but has to be adequately acknowledged in order to accomplish adequate public policy guidance.

Keywords: Creative employment; Occupations; Industries; Measurement; Portugal

JEL-codes: L80; C81

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"If there is no agreement on how to define and measure the creative class, there is little prospect that it will provide useful public policy guidance. If no one knows how the creative class is constituted … there are likely to be no effective policy levers." (Sands and Reese, 2008: 6)

1. Introduction

The literature on the creative class and industries is relatively recent and consists of an array of publications which range from theoretical and policy-based articles (Pratt *et al.*, 2009; Heinze and Hoose, 2013) to empirical studies on the estimation of creative employment in national and regional economies (Florida *et al.*, 2008; Asheim and Hansen, 2009; Mellander *et al.*, 2010).

Since Florida's (2002) seminal contribution, several studies and government reports have been published world-wide on the analysis of creative workers, their dimension (KEA European Affairs, 2006; Cunningham and Higgs, 2009), spatial, sector and knowledge-based distribution (Gabe, 2006; Clifton, 2008; Mellander, 2009), the determinants of their location preferences (Hansen and Niedomysl, 2009), and their effect on economic growth (Florida *et al.*, 2008).

Despite the reasonable amount of literature produced on the topic, several challenges remain for anyone undertaking empirical and quantitative analyses of creative activities (Çetindamar and Günsel, 2012; Lazzeretti *et al.*, 2012; Lysgård, 2012). Fuzzy and all-embracing definitions of which occupations should be included in the creative class (McGranahan and Wojan, 2007; Markusen *et al.*, 2008), lack of objectivity in the criteria to select who is creative or not (Boschma and Fritsch, 2009; Clark, 2009), limitations of data used, and problems of highly aggregated occupational code categories (Higgs *et al.*, 2008) seem to jeopardize an accurate analysis.

Hornidge (2011) suggests that it is useful to frame 'creative industries' as a boundary concept, defined by the different actors who use it in varying ways, and underlines that a common identity and common structure uniting these different definitions are still in the process of being constructed.

Intrinsically a theoretical construct, 'creative industries' must be operationalized before it can be used to direct and evaluate local policies (Reese *et al.*, 2010). However, the diversity of methodological proposals for estimating the creative employment and the

use of distinct datasets tend to hamper a rigours analysis and account of the magnitude of that creative employment. Based on distinct datasets, existing estimates of the weight of creative industry/ class range from a meagre 2.1%, for the UK, in 2008 (Clark, 2009), to a stunning 52.4%, for the Netherlands, in 2001 (Clifton and Cooke, 2009).

We aim at assessing the magnitude of creative employment by estimating its weight for all relevant existing methodologies - conventional approaches (DCMS traditional industry-based); occupation-based approaches (Florida's approach, occupation-based approaches following Florida's and the refinements of Florida's taxonomy); and the combined industry and occupation-based approaches (the creative trident approach and the 2010 DCMS methodology) - using a unique and comparable micro dataset (including over 3 million workers) from the official employment datasets of Portugal (reference year: 2009). This allows a comparable quantification and properly discussion of the distinct figures provided by each methodology.

In the next sections (2 and 3), we describe and map the most relevant existing measurement approaches. In Section 4 we estimate the size of the creative employment according to each approach, using Portugal data for the year 2009 as the reference case. Finally, in Section 5, we outline the most relevant contributions and policy implications of the present study.

2. Measuring the creative employment: a review of the main methodologies

The empirical literature on the measurement analysis of creative employment can be distinguished into two main conceptual perspectives: one, more economic and industrial-based, centred on *(creative) industries* and the other, more sociological-driven, based on *(creative) people.*

The first conventional measures employed in empirical studies on the creative economy have been developed with an *industrial perspective*, based on the conception of creativity as a productive process which generates wealth by the exploitation of intellectual property rights. In parallel with the industrial methodologies, a *sociological occupational perspective* on the creative employment – focused on what people do and their professional occupation – has emerged, associated with the concept of 'creative class' (see Florida, 2002, 2004).

The following sections describe the approaches developed within each perspective (Sections 2.1 and 2.2), as well as the approaches which combine industries and occupations (Section 2.3).

2.1. The industrial perspective: conventional industry-based approaches

In terms of measurement, these approaches make use of the Standard Industrial Classification (SIC) system in order to estimate the size of creative industries. Here, creative employment is computed "by allocating all jobs in earmarked creative establishments - actual physical locations of production and service - into nested industries defined by major product" (Markusen *et al.*, 2008: 29), and summing up of all the workers in all the creative industries.

This first generation of methods emerged with the UK Creative Industries Mapping Document (DCMS, 1998, 2001), focused on capturing empirical information about specialized industries in each sector of the creative economy, for governmental purposes. The creative employment, in this case, is simply measured by the existing employment in each 'creative' sector, considering both direct and indirect/ support activities in the process (DCMS, 1998, 2001).

Despite the relevance of the approach, drawbacks in delimiting the creative sectors led to difficulties in the measurement of creative activities, restricting the potential dimension of these industries. Indeed, the industry-based approach has been criticised by several authors (e.g., Pratt, 2004; Markusen *et al.*, 2008; Granger and Hamilton, 2010). It has been stated that the results provided lead to an underestimation of creative employment, since they include the total number of employees working within those considered as creative industries, but overlook the creative employment outside those industries. Besides, there are limitations of the SIC systems in use. Even the most recent SIC codes seem to be inadequate when it comes to capturing information on the creative industries. The SIC classification mostly relies on narrow coding which does not provide detailed information on each sector, even when codes are disaggregated at their maximum levels. This limits a refined analysis of each activity sector and does not provide a sufficient detail for an accurate treatment of creative activities, tending to mitigate or aggregate them into broad categories (Granger and Hamilton, 2010).

Moreover, creative processes are being developed across all the sectors of the economy, but SIC codes hardly capture those activities. This is particularly true for the Design and Digital Media sectors, which are often intertwined with other activity sectors, some of them outside the creative core, such as the categories of product development, industrial design and fashion design, which mostly operate within the manufacturing sectors. This is also the case of Architecture, Crafts, Visual and Performing arts, whose activities often take place outside the creative core, within the manufacturing and services sectors.

2.2. The sociological perspective: occupational-based approaches

Here, the Standard Occupational Classification (SOC) codes are used for the empirical estimation of creative employment, "[which] is divided into nested occupational groups based on skill content and work process", giving particular emphasis to what "workers do rather than what they make" (Markusen *et al.*, 2008: 29).

This line of research went beyond the industrial approaches by focusing on occupations instead of the aggregate employment of specialized industry sectors (Higgs and Cunningham, 2007). Unlike industry-based methodologies (e.g., DCMS, 1998, 2001), mostly centred on a restricted number of creative industries, occupational approaches broadened the dimension of creative employment by accounting for the occupations considered as creative in all the economic activities.

This type of measurement methodology allows for a detailed analysis of the creative workforce and the occupational structure over time, across regions and countries. For instance, Gabe (2006) used a shift-share model to study the evolution of creative workforce in urban areas of the United States (US), between 1990 and 2000, whereas McGranahan and Wojan (2007) developed a detailed analysis of creative categories in order to assess the occupational structure of US nonmetropolitan counties (cf. Table 2.1).

One frequent drawback pointed to occupational-based approaches is that activities considered as creative are often associated with those involving higher educational levels (Markusen *et al.*, 2008) to the detriment of others (e.g., craft work) that are also creative but associated with less formal education. In particular, as stressed by Glaeser (2005), by using census occupational data and grouping creative workers into high skilled categories, Florida's (2002) criteria led to biases in the measurement of creative

occupations. It was further uncovered that each occupational category code covered a diversity of detailed professions with their categorization as *creative* involving a high degree of arbitrariness (McGranahan and Wojan, 2007). On this issue, McGranahan and Wojan (2007) proposed a refinement of Florida's occupational groups based on a ranking of the creativity required by each given activity. This procedure conferred greater objectivity on the scrutiny of creative occupations, producing more robust estimations of creative employment than Florida's (2002) study.

Occupational approaches also overlook or neglect self-employed workers; since official source data mostly contain information on firms employing creative workers, they do not account for the self-employed, while their contribution to the creative economy appears to be significant (Van Steen and Pellenbarg, 2012). This problem is particularly relevant in the case of *bohemians*, for whom freelance works represent a significant part of their activity (Fritsch and Stuetzer, 2009). Finally, occupational-based approaches fail to permit the discrimination between the type of industries where creative workers operate and their industrial affiliation, since here, SIC codes are not taken into account.

2.3. The combined industry- and occupation-based approaches

Limitations of the two above approaches called for the development of a methodology making a combined use of the Standard Industrial and Occupational Classification (SIC/SOC) codes. The type of information gathered in this combined approach provides data on industries where creative workers are operating, and allows the identification of creative individuals working in non-creative sectors of activity, as well as of non-creative/ support labour existing in creative industries.

Higgs *et al.* (2008) proposed the 'creative trident' approach to map the creative economy, employing both industry and occupational codes (see Table 2.1). More recently, studies drawing on the DCMS industry-based approach (DCMS, 2006, 2010a,b) have enlarged their analysis of core creative sectors by using both industry and occupational codes. According to these studies and some other authors (e.g., Barbour and Markusen, 2007), combined industry and occupational-based approaches provide a richer account of the occupational distribution within industries.

Table 2. 1: Creative employment - a synthesis of empirical results in literature

Methodological Approach	Characteristics	Author(s) | Study	Methodology Followed	**Empirical results** - Relative weight of *creative employment* in total workforce
:: INDUSTRIAL PERSPECTIVE:: **Conventional, industry-based approach**	Under these approaches, mostly drawn from the **DCMS framework**, **estimates of creative employment are restricted to Core specialized creative sectors**. This leads to more modest estimations of creative employment than found with other approaches, particularly those following Florida's (2002, 2004) definition. [Use of SIC codes]	**DCMS (1998, 2001)**, *UK Creative Industries Mapping Document*	Creative employment is measured by the total employment in each of the thirteen core creative sectors, considering both direct and indirect or supporting/non-creative activities in the process.	UK (1998): 5%
		DCMS (2001), *Creative Industries Mapping Document 2001*	Creative employment is measured using a method closely following the DCMS (2001) framework - *industry-based approach*	UK (2001): 7%
		Boix *et al.* (2010), "The geography of creative industries in Europe: Comparing France, Great Britain, Italy and Spain"		France: 4.5%; Great Britain: 5.7%; Italy: 5.6%; Spain: 4.1%
		Curran and Van Egeraat (2010), "Defining and Valuing Dublin's Creative Industries"		Ireland (2006): 6.8%
		White (2010), "Creative industries in a rural region: Creative West. The creative sector in the Western Region of Ireland"		Western Region of Ireland (2008): 3%
:: SOCIOLOGICAL PERSPECTIVE:: **Occupational-based approach**	Under these approaches, estimates of creative employment cover **all the creative occupations across all the industry sectors** of the economy. This leads to a much ***broader* perspective of the creative class,** particularly because it **includes all the creative professionals,** a vast category that is present in almost all activity sectors. [Use of SOC codes]	**Florida (2002)**, *The rise of the Creative Class – and How it's Transforming Work, Leisure, Community and Everyday Life*	Creative Employment is determined on the basis of Florida's (2002, 2004) definition of creative class: *Super Creative Core; Creative Professionals*; and *Bohemians* (see Section 2).	US (1999): 30.0%, of which: *Super Creative Core*: 11.7%; *Creative Class*: 18.3%
		Florida (2005), *The Flight of the Creative Class: The New Global Competition for Talent*		*BROAD definition (including technicians)* (2002): UK: 33.8%; Germany: 40.2%; Norway: 41.6%; Denmark: 41.8%; Finland: 41.0%; Sweden: 42.4%; Netherlands: 47.0%; United States: 27.3%; Canada: 38.1% *NARROW definition (excluding technicians)*(2002): UK: 20.1%; Germany: 20.1%; Norway: 18.8%; Denmark: 213%; Finland: 24.7%; Sweden: 22.9%; Netherlands: 29.5%; United States: 23.6%; Canada: 25.0%
		Clifton (2008), "The 'creative class' in the UK: an initial analysis"	Estimation of Creative Employment in England and Wales (2001), following Florida's (2002, 2004) definition of creative class.	England and Wales Total (2001): 37.3%
		Clifton and Cooke (2009), "Creative knowledge workers and location in Europe and North America: a comparative review"	Estimation of Creative Employment in Europe, following Florida's (2004) *creative class* concept, *although considering a "small number of occupations"* as creative professionals (Clifton and Cooke, 2009: 79).	(2001): UK: 36.3%; Germany: 33.3%, Norway: 18.6%; Denmark: 27.6%; Finland: 33.4%; Sweden: 29.8%; The Netherlands: 52.4%
		Boschma and Fritsch (2009), "Creative Class and Regional Growth: Empirical Evidence from Seven European Countries"	Estimation of Creative Employment in 7 European countries (*Denmark, England and Wales, Finland, Germany, the Netherlands, Norway, and Sweden*), following Florida's (2002, 2004) definition of creative class.	7 developed European countries (2002): 37.7%, of which: Creative Core: 26%, Creative Professionals: 70%; Bohemians: 4%

(...)

Methodological Approach	Characteristics	Author(s) | Study	Methodology Followed	**Empirical results** - Relative weight of *creative employment* in total workforce
		Fritsch and Stuetzer (2009), "The geography of creative people in Germany"	Estimation of Creative Employment in West Germany, following Florida's (2002) definition of creative class.	West Germany (2004): 36.8%
		Mellander (2009), "Creative and Knowledge Industries: An Occupational Distribution Approach"	Estimation of Creative employment, by studying the occupational structure within industries (private sector) in Sweden, and following Florida's (2002) definition of creative class.	Sweden (2001): 36.8%
		Mellander et al. (2010), "Occupational and Industrial Distribution in Denmark: A comparison study with the United States, Canada and Sweden"	Estimation of Creative employment, by studying the occupational structure within industries in Denmark, in comparison with the United States, Canada and Sweden, and closely following Florida's (2002) definition of creative class.	Denmark(2007): 39.5%; USA (2005): 35.1%; Canada (2006): 30.9%; Sweden (2005): 43%
:: SOCIOLOGICAL PERSPECTIVE:: **Occupational-based approach**	**Refinements of Florida** Here, **refinements of Florida's (2002) taxonomy** are developed to restrict creative occupations to those that the authors believe are actually creative. [Use of SOC codes]	**Gabe (2006),** "Growth of Creative Occupations in U.S. Metropolitan Areas: A Shift-Share Analysis"	Recasting of Florida's (2002) concept, restricting the analysis of creative employment to <u>six categories</u>: *"management; computer and mathematical; architecture and engineering; life, physical, and social science; education, training, and library; and arts, design, entertainment, sports, and media occupations".*	USA urban (1999): 18.1%
		McGranahan and Wojan (2007), "Recasting the Creative Class to Examine Growth Processes in Rural and Urban Counties"	Recasting of Florida's (2002) measure, by the <u>exclusion of occupational categories</u> from the summary groups of 'Business', 'Educational' and 'Legal' occupations and by excluding the whole summary category of 'Healthcare' occupations.	Urban USA (2003): 30.9% Rural USA (2003): 19.4%
:: COMBINED INDUSTRY and OCCUPATION-BASED APPROACHES [Mostly drawn upon the *DCMS framework*]	Under these approaches, estimates of creative employment are calculated by <u>all the ***occupations***</u> **(creative occupations + non-creative/support occupations) <u>in Core creative sectors</u>** (specialist and support mode) + **<u>All the *creative occupations* in non-creative sectors</u> of activity** (embedded creative employment) [Use of SIC and SOC codes]	**Higgs *et al.* (2008),** *Beyond creative industries: Mapping the creative economy in the UK* (coord. Higgs, P., Cunningham, S. and Bakhshi, H.)	- The selection of 'core creative sectors' is mostly drawn from the *DCMS framework*; - For creative employment, the authors develop the *Creative Trident* approach: **CREATIVE employment** = <u>*specialist* and *support* creative occupations in the 'specialized creative sectors</u>' - the *Core Creative industries*, or those dedicated to the 'pre-creation' and 'creation' stages of the process + All the <u>creative occupations in non-creative sectors of activity</u> (*embedded creative employment*), namely, in sectors such as 'manufacturing' , 'real estate', 'business activities', 'wholesale and retail trade', and 'financial intermediation'.	UK (2001): 7.1%

(...)

Methodological Approach	Characteristics	Author(s) | Study	Methodology Followed	Empirical results - Relative weight of *creative employment* in total workforce
		Clark (2009), "Crunching creativity: an attempt to measure creative employment"	Use of original DCMS framework with 2003 SIC codes (less specified industry categories).	UK (2008): 5.5%
			Use of a ***SIC SOC matrix*** with UK 2007 SIC codes formulation, which provide a more detailed specification of each industry's grouping category.	UK (2008): 2.1%
		DCMS (2010a), *Creative Industries Economic Estimates (Experimental Statistics) - December 2010*	**DCMS framework combined with occupational data based on SOC system** - Use of *combined industry and occupational approach* to measure the creative employment in the industry sectors of the UK. Creative employment is measured by: **"Employment in the Creative Industries" + "Employment in creative occupations in businesses outside the Creative Industries"** (DCMS, 2010a)	UK (2010): 7.8%

Industries' employment structures diverge significantly from region to region and changes in regional labour structures and in the economic dynamics of industries may gain from a combined industry and occupational approach, for a better interpretation of occupational mobility across sectors over time (Barbour and Markusen, 2007; Currid and Stolarick, 2010). In this vein, such an approach is useful for regional policy implementation and management.

Despite the advantages of using these approaches, they are not free from limitations. Restrictions of source information and of nomenclatures in use, such as highly aggregated data particularly on industries, long time intervals between each data upgrading process, limited knowledge on the self-employment, as well as difficulties in matching SIC with SOC codes and in capturing the creative component, are some of the major shortcomings reported by authors using combined industry and occupational-based approaches (Higgs and Cunningham, 2007; Higgs *et al.*, 2008).

Summing up, extant empirical studies on the measurement of creative employment show that the methodologies based in the *industrial perspective*, such as the DCMS traditional approach, generally lead to more restricted figures of the creative employment, as they only consider the number of workers in the core of creative industries. In contrast, the *sociological perspective*, including the occupational-based approaches of Florida and those following Florida's taxonomy, produces broadened results since they envisage the 'creative class' as a wide group of professional categories considered as *creative*, regardless of the economic activity sector. The empirical studies based on combined industry and occupational-based approaches evidence larger figures than those based on the industry perspective, as they also take into account the creative employment in the non-creative activity sectors, but inferior to that obtained by exclusively occupational-based approaches (see Table 2.1 and Figure 2.1).

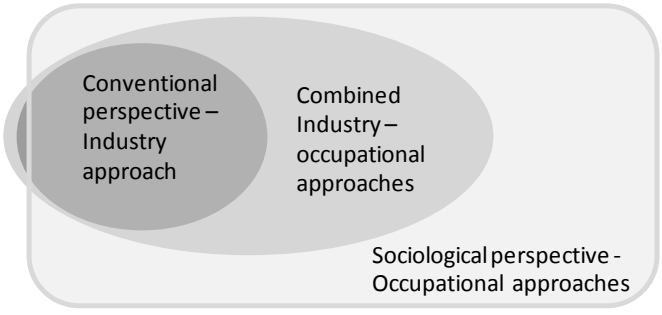

Figure 2. 1: The boundaries of the creative employment according to the main measurement perspectives

3. Mapping the distinct methodologies used in literature

3.1. Industrial perspective: conventional approach

The methodological details regarding the selection of sectors and the industry codes included were in direct correspondence with the taxonomy on creative sectors inspired by the original DCMS (1998, 2001) reports.[9]

In order to guarantee that this mapping would be as accurate as possible, we used detailed 4 and 5 digit industry codes, the maximum resolution of the latest Portuguese classification on economic activities (CAE - Rev. 3). We also used the International Standard Industrial Classification - Rev. 3.1 codes, compatible with the UK SIC 2003 codes presented in the DCMS (2010b) technical note. To make an adequate correspondence between these codes and our nomenclature on industries, we converted all the ISIC - Rev. 3.1 into the latest ISIC - Rev. 4 codes, which have an appropriate compatibility with the structure of the Portuguese SIC system, *CAE - Rev. 3* (see Table 2.2 for a summary description). [10]

The industry sectors mapped are grouped into the following segments (cf. DCMS, 2010b): 'Advertising'; 'Architecture'; 'Arts and Antiques', 'Crafts'; 'Design'; 'Designer Fashion'; 'Video, Film and Photography'; 'Music and the Visual and Performing Arts'; 'Publishing'; 'Software, Computer Games and Electronic Publishing'; and 'Radio and TV'.

Following this approach, in the segments of 'Architecture', 'Arts and Antiques', 'Designer Fashion', 'Video, Film and Photography', 'Music and the Visual and Performing Arts', and 'Publishing', only a portion of the total employment of each relevant industry code was taken, as these sectors also incorporate a large number of technical, administrative or functional activities, that is, non-creative employment.

In 'Crafts' segment, no SIC codes were included by the DCMS report on the grounds that "the majority of businesses was too small to be picked up in business surveys" (DCMS, 2010b: 2). By the same token, it was argued that 'handicraft activities' could

[9] Since the recent DCMS (2010b) report is an updated version of the official industry-based framework, and to the best of our knowledge there are no publicly available methodological notes on the first DCMS (1998, 2001) industry-based reports, we used the technical note of the DCMS (2010b) report, mapping the part corresponding to the core creative industries/ sectors - where the DCMS used UK SIC 2003 codes - in order to analyse the traditional DCMS industry-based approach.

[10] Sources: *CAE* - Rev. 3 – Portuguese Classification of Economic Activities, the most recent revision is available online at: http://metaweb.ine.pt/sine/ [accessed September 2014].

not be accurately described by using industry classification systems and business surveys, so the information on these activities was absent from the DCMS report. Yet, given that these activities are listed as core creative, we included the industrial codes that best represented craftwork and traditional trades, namely: 'ceramics', 'glass products manufacture', 'production of wooden articles' and 'jewellery', considering, in terms of creative employment, a small proportion of each code (5%).[11]

Table 2. 2: The mapping of DCMS industry-based approach

Core Creative Sectors	UK 2003 SIC codes	Proportion of code taken	ISIC Rev. 4 codes	Portuguese SIC codes CAE - Rev. 3 - 5 digits
1. Advertising	74.40	100%	7310; 7320	73110; 73120; 73200
2. Architecture	74.20	25%	7110; 7120	71110; 71120; 71200
3. Arts and Antiques	52.48/ 9; 52.50	5%	4774; 4791	47790
4. Crafts*	"Majority of businesses too small to be picked up in business surveys" (source: DCMS, 2010b: 2)	-	-	23411; 23412; 23413; 23414; 23110; 23120; 23131; 23132; 23140; 23190; 16291; 16292; 32110; 32121; 32122; 32123; 32130
5. Design	"No codes match this sector" (source: DCMS, 2010b: 2)	-	-	74100
6. Designer Fashion	17.71; 17.72; 18.10; 18.22; 18.23; 18.24; 18.30; 19.30	0.5%	1410; 1420; 1430; 1512; 1520;	14110; 14120; 14131; 14132; 14133; 14140; 14190; 14200; 14310; 14390; 15120; 15201; 15202
	74.87	2.5%	7410	74100
7. Video, Film & Photography	92.11; 92.12; 92.13; 22.32 74.81	100% 100% 25% 25%	5911; 5912; 5913 5914 1820 7420	59110; 59120; 59130 59140 18200 74200
9&10. Music and the Visual & Performing Arts	22.14; 22.31 92.31; 92.32; 92.34 92.72	25% 100% 25%	5920 9000; 7990 9321; 9329	59200 90010; 90020; 90030; 90040; 79900 9321; 9329
11. Publishing	22.11; 22.12; 22.13 22.15 92.40	100% 50% 100%	5811; 5813 5819 6391; 6399	58110; 58130; 58140 58190 63910; 63990
8&12. Software, Computer Games & Electronic Publishing	22.33 72.21 72.22	25% 100% 100%	1820 5820 6201; 6202	18200 58210; 58290 62010; 62020
13. Radio & TV	92.20	100%	6010; 6020	60100; 60200

Sources: The selection of codes was based on DCMS (2010b) "Creative Industries Economic Estimates - 10 February 2010" - Annex A, available online at: https://www.gov.uk/government/publications/creative-industries-economic-estimates-february-2010 [accessed September 2014].
Correspondence Tables between ISIC Rev. 3.1 and ISIC Rev. 4 available online at: http://unstats.un.org/unsd/cr/registry/regso.asp?Ci=60 [accessed September 2014].
The Portuguese nomenclature CAE (*Classificação das Actividades Económicas*) has direct correspondence with ISIC Rev. 4.
* It was considered here some codes representing traditional manufacturing related with Crafts activities (ceramics design and decoration, glass, wooden articles and jewelry); the proportion used was 5%.

[11] The average portion of 5% was in line with figures already reported in existing empirical literature, such as the *World Intellectual Property Organization* (WIPO) studies, available online at: http://www.wipo.int/export/sites/www/copyright/en/performance/pdf/economic_contribution_analysis_2012.pdf [accessed September 2014].

The mere use of industrial (SIC) codes, the inclusion of a restricted number of industry sectors in the creative core, and the degree of arbitrariness in the portions attributed to each industrial code have been generally criticized in the literature (Markusen *et al.*, 2008; Clark, 2009). Furthermore, the basic consideration of creative employment as the number of workers operating inside a core of creative sectors, overlooking the creative employment that exists outside that established core, was found, as earlier referred, to be a major limitation of the DMCS approach, in particular, and of conventional industry-based approaches, in general.

The application of this approach to map and estimate the dimension of creative employment in Portugal, provided quite small figures of the creative employment, which might in part be explained by the limitations of the SIC system used (despite the use of a very detailed 5-digit codes) and the application, according to the DCMS proposal, of the somehow arbitrary portions of the industries' employment considered.

3.2. Sociological perspective: occupation-based approaches

3.2.1. Florida's original proposal

The second wave of methodologies to analyse the creative employment resorts to a sociological perspective of creative employment (the 'creative class') and focuses on occupations rather than on industrial sectors. The most influential occupation-based approach was developed by Florida (2002, 2004). In it, all the creative occupations throughout the activity sectors of the economy were extensively scrutinized and categorized into two major groups: the 'Super Creative Core' and the 'Creative Professionals'.

In the 'Super Creative Core', which comprises all the occupations in artistic fields (e.g., performing arts, media, entertainment or design activities), and scientific domains (namely, science, engineering, architecture and education), we included all the professions that, according to Florida (2002), are directly engaged in the creative process. Hence, all the occupational categories relative to 'Computer and mathematical occupations'; 'Architecture and engineering occupations'; 'Life, physical and social science occupations'; 'Education, training and library occupations'; and 'Arts, design, entertainment, sports and media occupations' have been selected (see Table 2.3).

Although Florida (2002) uses broad summary occupational categories in his definition, we mapped his approach using ISCO-08 codes with their maximum detail and

occupational nomenclature CPP2010 at a 5-digit level to assure greater precision and detailed information on this scrutiny.[12] All the codes were considered in their whole proportion (100%), corresponding to the total number of workers in each occupational category considered, in all the activity sectors of the economy.

The broader group of 'Creative Professionals', a class of technicians whose main purpose is to deal with daily problem resolution in a variety of knowledge-intensive and services segments such as "high-tech sectors, financial services, the legal and healthcare professions, and business management" (Florida, 2002: 69), was also comprehensively mapped. During this exercise, it was evident that these professionals generally have a high academic background and were highly skilled workers in their occupational category.

Here, a vast group of professions and their occupational codes were considered for a wide variety of fields: 'Management occupations'; 'Business and financial operations occupations'; 'Legal professionals'; 'Health professionals (except nursing)'; 'Nursing and midwifery professionals'; 'Life science and health associate professionals'; 'Physical, chemical, construction and engineering sciences associate professionals'; and 'Finance and sales associate professionals' (cf. Table 2.3).

Despite the practical simplicity of this approach and the interesting focus on studying occupations instead of industry sectors, certain shortcomings were detected. When mapping Florida's (2002) proposal, we found three limitations that corroborated critiques already levelled before (see Glaeser, 2005; Markusen, 2006): i) the use of vast, wide-ranging and summary category groups, which often overlooked the detail of each occupation present in the broad categories included; ii) the correlation between occupations considered as creative and highly skilled, educated professions; iii) the absence of handicraft workers, crafts occupations, and skilled labourers related to traditional, artisanal or hand-made activities, which Florida does not consider in his definition, and that may also be creative occupations.

[12] Sources: CPP2010 - Portuguese Classification of Occupations of 2010, is compatible with ISCO-08, and is available at http://metaweb.ine.pt/sine/ [accessed September 2014]; ISCO-08 codes are available at http://www.ilo.org/public/english/bureau/stat/isco/isco08/ [accessed September 2014].

Table 2. 3: Florida's definition of 'Creative Class' - Occupational categories

***Creative Class* category groups**	**Occupational Categories Descriptions**	**Occupational ISCO-08 Codes** (summary categories) / Portuguese Standard Occupational codes CPP - 2010 (summary categories)*
Super Creative Core	. Computer and mathematical occupations; . Architecture and engineering occupations; . Life, physical and social science occupations; . Education, training and library occupations; . Arts, design, entertainment, sports and media occupations	. Computing professionals (25); . Mathematicians, Statisticians and related professionals (212); . Architects, Engineers and related professionals (214; 215; 216); . Life Science professionals (213); . Physicists, Chemists and related professionals (211); . Social Science and related professionals (263); . University and higher education teachers (231); . Vocational, technological and artistic education teachers (232); . Secondary and basic education teachers (233); . Primary school and early childhood teachers (234); . Other teaching professionals (235); . Archivists, museum curators and related information professionals (262) + ***Bohemians*** . Authors, journalists and linguists (264); . Creative and performing artists (265); . Product and garment designers (2163); . Graphic and multimedia designers (2166); . Musicians, singers and composers (2652); . Dancers and choreographers (2653); . Film, stage and related directors and producers (2654); . Actors (2655); . Announcers on radio, television and other media (2656); . Creative and performing artists not elsewhere classified (2659); . Advertising and marketing professionals (2431); . Public relations professionals (2432); . Artistic, Entertainment and Sports associate professionals (342; 343); . Telecommunications and broadcasting technicians (352); . Fashion and other models (5241)
Creative Professionals	. Management occupations; . Business and financial operations occupations; . Legal occupations; . Healthcare practitioners and technical occupations; . High-end sales and sales management	. Legislators, senior officials and managers (1); . Finance professionals (241); . Administration professionals (242); . Financial and mathematical associate professionals (331); . Sales and purchasing agents and brokers (332); . Business services agents (333); . Legal professionals (261); . Health professionals (except nursing) (221; 223; 224; 225; 226); . Nursing and midwifery professionals (222); . Nursing and midwifery associate professionals (322); . Life science technicians and related associate professionals (314); . Medical and pharmaceutical technicians and health associate professionals(321; 323; 324; 325); . Physical and engineering sciences technicians (311; 312; 313; 315); . Information and communications technology operations and user support technicians (351); . Regulatory government associate professionals not elsewhere classified (3359); . Finance and sales associate professionals (2433; 2434)

Sources: Florida (2002, 2004), Fritsch and Stuetzer (2009). The selection of codes is from the responsibility of this article's authors as a result of their interpretation on Florida's category groups and respective descriptions.
Note: * The detailed mapping at a 5-digit level can be provided upon request to the authors.

3.2.2. Proposals following Florida's

Closely following Florida's (2002, 2004) approach, Boschma and Fritsch (2009) present a taxonomy for delimiting the creative class. Accordingly, when mapping these latter

authors' approach, we considered all the occupations in categories related to 'Computing', 'Science', 'Architecture and Engineering', 'Health (except nursing)' and 'Education', as being part of the 'Super Creative Core'. 'Creative Professionals' included all categories in the fields of 'Management and Legislation', 'Nursing', 'Business and Administration', 'Legal services', 'Administrative work', and 'Personal and Social services'. Finally, in 'Bohemians', we considered all the occupational categories related to 'Arts, Design, Entertainment, Sports and Media' (see Table A2.1, in Annex 2).

The mapping of this approach was quite similar in structure to that presented in the case of Florida's (2002), leading to a comprehensive categorization of the creative occupations. In addition to the categories that were presented by Florida, Boschma and Fritsch's (2009) categories also included the 'Administrative Associate professionals' in the segment of 'Creative Professionals'. In Florida (2002) these occupations appeared in the non-creative service class. This obviously leads to more inflated results when compared to those obtained by using Florida's approach.[13]

The approaches which closely follow Florida's taxonomy share the same characteristics and the limitations of the original proposal, especially those related to the use of broad summary category groups in their definition of the creative class.

3.2.3. Refinements of Florida's proposal

McGranahan and Wojan (2007) undertook a detailed analysis of all the summary occupational groups in Florida's taxonomy and proposed a refinement approach on the basis of the creativity required by each professional activity. The recasting was based on the information from a publicly available database - the *U.S. O*NET database* - which features the creativity level involved in each occupation, described by the proxy "[d]eveloping, designing or creating new applications, ideas, relationships, systems or products, including artistic contributions"[14] (McGranahan and Wojan, 2007: 201).

[13] Another recent study closely following Florida's approach is that by Mellander *et al.* (2010), who used Florida's definition of 'creative class' to study the occupational structure by type of industry. The mapping procedure is, nevertheless, rather similar to Florida's approach so we opted to not present it here.

[14] Despite the use of more objective criteria on the selection of creative occupations, McGranahan and Wojan (2007: 200) recognise that the "creativity measure provides [an] arguably imperfect, reference for assessing the creativity requirements among summary occupations".

We mapped this refinement approach of McGranahan and Wojan (2007) by excluding all those that were regarded by the authors as less creative occupations in the summary categories fully accounted by Florida (2002). Hence, in 'Management occupations', we removed all the occupations related to 'farmers and farm managers' (see Table A2.2, in Annex 2). From 'Healthcare practitioners and technical occupations', all the categories were excluded. In 'Education, training, and library occupations', only 'post-secondary teachers' and 'librarians, curators and archivists' were included. In 'Business and financial operations', only 'accountants and auditors' were considered. In 'Legal occupations', only 'lawyers' were included. From 'Life, physical and social science occupations', we excluded all the associated technicians. The summary category of 'Computer and mathematical occupations' was taken into account in full. The summary group of 'Architecture and engineering occupations' was also fully included in the recast measure. All the occupations related to 'Arts, design, entertainment, sports, and media' activities were wholly accounted. And finally, in 'High-end Sales', all the occupational codes related with 'sales representatives' and with the residual category of 'other sales and related occupations, including supervisors' were included.

Since the code descriptions used by the authors on their recasting - US SOC 2000 - and the occupational nomenclatures that we used - ISCO-08 and CPP2010 - did not match exactly, the codes to be considered in our mapping were selected according to our interpretation of McGranahan and Wojan's (2007) refinement criteria, based on the *O*NET database* of occupations.[15] By the same token, the descriptions of major category groups considered may differ slightly from those presented in McGranahan and Wojan (2007), but all the codes included properly describe the refined measure developed by these authors.[16]

Another refining approach of Florida's original proposal was developed by Gabe (2006), who focused on Florida's 'Super Creative Core', adding up to this latter category all the management occupations. Thus, on mapping this approach we included all the detailed occupational codes which make up the summary categories of 'Computer and mathematical occupations', 'Architecture and engineering occupations', 'Life, physical and social science occupations', 'Education, training and library

[15] Available online at: http://www.onetonline.org/find/descriptor/browse [accessed September 2014].
[16] In this assessment, we undertook a detailed analysis on the categories that were recast by McGranahan and Wojan (2007: 201) and the structure of the US SOC 2000 codes of the U.S. Bureau of Labour Statistics, using the information available online at: http://www.bls.gov/soc/2000/socstruc.pdf [accessed September 2014].

occupations', 'Arts, design, entertainment, sports and media occupations', 'Media and communication equipment workers', and all 'Management occupations' (see Table A2.3, in Annex 2). All the categories excluding the latter ('Management occupations) coincide with Florida's (2002) 'Super Creative Core'.

Although relying upon more objective criteria in the selection of creative occupations, based on the *O*NET* occupational database, given that they only suggest a recasting of the summary categories present in Florida's definition, these refinement proposals continue to conflate human capital with creativity. The occupational groups considered in these proposals had already been subject to criticism (see Glaeser, 2005) and the authors did not go beyond those categories in their refinement approaches. Indeed, 'Jewellers', 'hand sewers and seamstresses', 'fabric and apparel patternmakers', 'precious metal workers', 'painting, coating, and decorating workers', 'potters', 'pre-press technicians', and other skilled workers in a vast array of manufacturing sectors (e.g., printing sector, wood, glass, ceramics, furniture, textiles), including occupations that also require creative thinking, continue to be absent from these refinement proposals.

3.3. The combined industry and occupation-based approach

3.3.1. The creative trident

The creative trident method, presented by Higgs *et al.* (2008), proposes to measure creative employment by taking into account three types of creative workers: i) 'Specialist creative workers', employed in the creative occupations operating in the creative industrial sectors; ii) 'Support workers', non-creative occupations engaged in support activities, such as management, administrative, technical, in the creative sectors; and iii) 'Embedded creative workers', comprising individuals in creative occupations in non-creative sectors. According to this methodology, the sum of these three types of employment, in the selected creative occupations and industry sectors, gives the total creative employment in the economy.

This methodological proposal was mapped using the details provided by Higgs *et al.* (2008) in the technical Annex of their report. To achieve the best possible accuracy in this mapping, we used the most recent industry codes - CAE - Rev. 3 - at their maximum detail, compatible with the latest international ISIC - Rev. 4 codes, in order to describe all the industry sectors that best corresponded to the creative industries defined

by Higgs *et al.* (2008). To define the core creative sectors, Higgs *et al.* (2008: 27) took as a departure point the Frontier Economics (2007) framework and selected all those industries directly involved in "the pre-creation and creation stages of the value chain", which they called the "creative core".

Although the creative trident approach differs from the recent industry and occupational-based approach of DCMS basically at the level of improvements included, the selected creative sectors were aligned "with the 13 sectors that make up the official DCMS measure of the creative industries" (Higgs *et al.*, 2008: 19), which permits direct comparisons between these two approaches. The core creative sectors covered the following segments: 'Advertising and Marketing'; 'Architecture', 'Visual Arts and Design'; 'Film, TV, Radio and Photography'; 'Music and Performing Arts'; 'Publishing'; and 'Computer Software' (cf. Table 2.4). [17]

The set of creative occupations has been mapped as corresponding to all workers whose primary purpose was the engagement in creative functions and who were directly involved in the production and creation stages. In their definition, Higgs *et al.* (2008: 28) included: i) "those engaged in producing primary creative output - for example, writers, musicians, visual artists, film, television and video makers, sculptors and craftspeople"; ii) "those engaged in interpretive activity - for example, performers interpreting works of drama, dance, music, etc. in a wide variety of media from live performance to digital transmission via the Internet"; and iii) "those supplying creative services in support of artistic and cultural production - for example, book editors, lighting designers, music producers, etc.".

We mapped all the occupational codes according to the nomenclature UK SOC 2000, followed by Higgs *et al.* (2008: 60) in their technical Annex, and using the corresponding codes of the latest international ISCO-08 system and of Portuguese most recent occupational nomenclature CPP 2010 (cf. Table 2.4).

During the mapping exercise, even though a suitable correspondence was found between the different industrial nomenclatures used, it was difficult to thoroughly describe the creative activities in some of the codes, particularly those related to all-

[17] Higgs *et al.* (2008) excluded some industry sectors and some occupations considered by the DCMS industry and occupational-based approach as being creative. They also added other industries and professions to their definition of Creative Core that were not considered by the DCMS industry and occupational-based approach. For further details see Higgs *et al.* (2008: 27-30).

inclusive or residual categories such as 'Other entertainment activities' or 'Recreational, cultural and sporting activities not otherwise specified'.

Table 2. 4: Combined industry- and occupational-based approach - the Creative Trident

Creative Sectors	UK 2003 SIC codes	ISIC Rev. 4 codes	Portuguese CAE - Rev 3 codes - 4 digits	SOC2000 - occupational UK codes	ISCO - 08 codes - 4 digits	Portuguese Occupational Codes (Portuguese CPP 2010) - 4 digits
1. Advertising	Advertising (744)	7310; 7320	7311; 7312; 7320	Advertising and public relations managers (1134); Marketing associate professionals (3543)	1221; 1222; 2431; 4227	1221; 1222; 2431; 4227
2. Visual Arts, Design and Architecture	Manufacture of jewelry and related articles (362)	3211; 3212	3211; 3212; 3213	Artists (3411); Goldsmiths (5495); Hand craft occupations (5499); Glass and ceramics makers, decorators and finishers (5491); Furniture makers/ craft woodworkers (5492)	2651; 7311; 7313; 7314; 7315; 7316; 7317; 7521; 7522; 7318; 7319; 7531	2651; 7311; 7313; 7314; 7315; 7316; 7317; 7521; 7522; 7318; 7319; 7531
	Design (no UK SIC code)	7410	7410	Graphic designers (3421); Product, clothing designers (3422)	2163; 2166; 3432	2163; 2166; 3432
	Architecture (74201)	7110	7111	Architects (2431); Town planners (2432); Architectural technologists and town planning technicians (3121); Design and development engineers (2126); Draughts persons (3122)	2161; 2162; 2164; 2165; 3118	2161; 2162; 2164; 2165; 3118
3. Film, TV, Radio and Photography	Motion Picture and Video activities (921); Radio and TV activities (922)	5911; 5912; 6010; 6020; 7420	5911; 5912; 6010; 6020; 7420	Arts officers, producers and directors (3416); Broadcasting associate professionals (3432); Photographers and audio-visual equipment operators (3434)	2654; 2656; 3521; 3435; 3431	2654; 2656; 3521; 3435; 3431
4. Music and the Performing Arts	Recreational, cultural and sporting activities (920); Other entertainment activities (923)	5920; 9000; 9321; 9329	5920; 9001; 9002; 9003; 9004; 9321; 9329	Musicians (3415); Actors, entertainers (3413); Dancers and choreographers (3414)	2652; 2653; 2655	2652; 2653; 2655
5. Publishing	Publishing (221); News agencies (924); Library, archives, museums and other cultural activities (925)	5811; 5812; 5813; 5819; 7490; 9101; 9102; 9103; 6391; 6399	5811; 5812; 5813; 5814; 5819; 7430; 9101; 9102; 9103; 9104; 6391; 6399	Authors, writers (3412); Journalists, newspaper and periodical editors (3431); Originators, compositors and print preparers (5421); Librarians (2451); Library assistants/clerks (4135); Archivists and curators (2452)	2641; 2642; 2643; 7321; 2621; 2622; 3433	2641; 2642; 2643; 7321; 2621; 2622; 3433
6. Computer Software	7220 Computer Software consultancy ('72 Computer and related activities')	6201; 6202; 6209	6201; 6202; 6203; 6209	Software professionals (2132); IT strategy and planning professionals (2131)	2511; 2512; 2513; 2514; 2519; 2521; 2522; 2523; 2529; 3511; 3512; 3513; 3514	2511; 2512; 2513; 2514; 2519; 2521; 2522; 2523; 2529; 3511; 3512; 3513; 3514

Note: The selection of codes is of the responsibility of the present paper's authors, according to their interpretation of Higgs *et al.* (2008: 59-61) selection of industrial (UK SIC 2003) and occupational (UK SOC 2000) codes. The respective occupational codes were converted into the recent versions of ISCO-08 and the Portuguese CPP2010.

Estimations of this SIC-SOC approach were carried out by considering the whole proportion (100%) of employment in each industry and occupational code. The procedure for estimating the creative employment encompassed the inclusion of all 'Specialist' and 'Support' workers in each defined creative sector, plus the 'Embedded creative workers', *i.e.*, those in the selected creative occupations, but operating in all the non-creative sectors of the economy.

3.3.2. The 2010 DCMS proposal

In a similar way to the creative trident approach, besides the total employment in the selected creative industries, all the creative workers operating outside the defined core creative sectors are taken into account in the 2010 DCMS methodological proposal (DCMS, 2010a).

The selection of creative sectors followed the original DCMS framework, which lists the following segments: 'Advertising and Marketing'; 'Architecture'; 'Arts and Antiques'; 'Crafts'; 'Design'; 'Designer Fashion'; 'Video, Film, and Photography'; 'Radio and TV'; 'Music and the Visual and Performing Arts'; 'Publishing'; and 'Software and Electronic Publishing' (Table 2.5).

In this mapping, we use the latest international ISIC - Rev. 4 codes and the corresponding national industry codes CAE - Rev. 3 to describe all the industry sectors that best match the core creative industries defined by DCMS (2010a).

According to DCMS (2010a), when industry sectors that were considered as creative also comprised non-creative activities only a portion of the code was accounted in the estimations. This was the case of 'Photographic activities', where only 25% of the code was considered, and the case of the vast number of manufacturing codes on 'Textiles and apparel', where a portion of only 0.5% was taken to describe Fashion Design activities. The proportion considered represents an attempt to extract the share of creative employment in those industry sectors.

The industry code describing Design activities was, in accordance with DCMS (2010a), divided in three major segments: 4.5% of the code was included in the 'Architecture' segment, 89.7% was integrated in the 'Design' segment, and the remaining 5.8% was incorporated into 'Designer Fashion'. This partition allowed for a better differentiation of the design activities and did not affect the overall result since the code as a whole is considered in the total calculation of the creative employment in all the creative

industries. Worthy of note is the ‘Crafts’ sector, where, according to DCMS (2010a), no industry codes were considered on the basis that the SIC system could hardly describe handicraft and craftwork activities. Here, using the SOC nomenclature, a set of creative occupations was defined as to extract the number of handicraft workers across the sectors of the economy (see Table 2.5). Then the estimation for the total employment in creative industries was given by the sum of all the workers operating in the defined creative sectors.

In order to estimate the number of creative workers outside the core creative sectors, DCMS (2010a) presented a selection of creative occupations using the UK SOC 2000 codes that best fitted those professional activities, in each creative sector. On mapping these occupations, we used the latest international ISCO-08 codes and the corresponding national occupational codes of the CPP 2010. Following DCMS (2010a), in the cases of skilled workers operating in the manufacturing sectors, such as ‘labourers in building and woodworking trades’, a portion of 5% of the respective occupational codes was included in the estimations. This portion is intended to capture the share of creative workers inside those vast occupational categories. In the case of ‘Product, clothing and related designers’, a portion of 93.9% of the respective occupational codes was considered in the segment of ‘Design’ and the other 6.1% was included in ‘Designer fashion’. In the overall estimate of total creative employment, product and garment designers were fully accounted.

The DCMS (2010a) approach has brought some necessary updates and adjustments to its original framework. By making use of occupational codes, this approach provided a broadened account of creative employment since it now takes into account the creative workers operating inside and outside the creative core industries. Moreover, it considers crafts occupations in the analysis and also presents a clearer differentiation between the creative sectors (e.g., Design *vs.* Designer Fashion) through the partition of industry and occupational codes.

The estimation of creative employment through this approach, considering its details on codes, partitions and portions taken (which are somehow *ad hoc* and do not account for changes in the industrial and occupational structure), turned out to be anything but simple during the programming task for the extraction of data by code.

Table 2. 5: The 2010 DCMS proposal: combined Industry-Occupational approach

Core Creative Sectors	UK 2007 SIC codes	Portion of SIC codes	ISIC Rev.4 codes	Portuguese CAE - Rev 3 codes	SOC2000 - occupational UK codes	ISCO - 08 codes - 4 digits	Portuguese Occupational Codes (Portuguese CPP 2010) - 4 digits
1. Advertising and Marketing	Advertising (73.11); Media Representation (73.12)	**100%**	**7310; 7320**	**7311; 7312; 7320**	Advertising and public relations managers (1134); Marketing associate professionals (3543); Public Relations Officers (3433)	**1221; 1222; 2431; 2432; 4227**	**1221; 1222; 2431; 2432; 4227**
2. Architecture	Architectural activities (71.11); Design activities (74.10)	**100%** **4.5%**	**7110; 7410**	**7111; 7410**	Architects (2431); Town planners (2432); Architectural technologists and town planning technicians (3121)	**2161; 2162; 2164; 2165**	**2161; 2162; 2164; 2165**
3. Arts and Antiques	Retail sale in commercial art galleries (47.78/1); Retail sale of antiques including antique books, in stores (47.79/1);	**100%**	**4774**	**47790**	"No SOC codes match this sector" (DCMS, 2010a: 23).		
4. Crafts	"Majority of businesses too small to be picked up in business surveys" (DCMS, 2010a: 20).				Floral arrangers/ florists (5496); Hand craft occupations n.e.c. (5499); Musical instrument makers and tuners (5494); Goldsmiths (5495); Glass and ceramics makers, decorators (5491); Glass and Ceramics process operatives (8112); Furniture makers, other craft woodworkers (5492); Laborers in Building and Woodworking trades (9121) (5% of SOC); Pattern makers (5493)	**6113; 7311; 7312; 7313; 7314; 7315; 7316; 7317; 7521; 7522; 7523 (5% of SOC); 7318; 7319; 7531; 7532**	**6113; 7311; 7312; 7313; 7314; 7315; 7316; 7317; 7521; 7522; 7523 (5% of SOC); 7318; 7319; 7531; 7532**
5. Design	Design activities (74.10)	**89.7%**	**7410**	**7410**	Artists (3411); Product, Clothing and related designers (3422) (93.9% of SOC); Graphic designers (3421); Design and Development engineers (2126)	**2651; 2163 (93.9% of SOC); 2166; 3432**	**2651; 2163 (93.9% of); 2166; 3432**
6. Designer Fashion	Clothing manufacturing UK SIC 2007 codes (14.11, 14.12, 14.13, 14.14, 14.19, 14.20, 14.31, 14.39, 15.12, 15.20)	**0.5%**	**1410; 1420; 1430; 1512; 1520**	**1411; 1412; 1413; 1414; 1419; 1420; 1431; 1439; 1512; 1520**	Product, Clothing and related designers (3422) (6.1% of SOC); Weavers and Knitters (5411)	**2163 (6.1% of SOC); 7533**	**2163 (6.1% of SOC); 7533**
	74.10	**5.8%**	**7410**	**7410**			
7. Video, Film and Photography	Motion picture and video production activities (59.11; 59.12); Motion picture and video distribution activities (59.13); Motion picture projection activities (59.14)	**100%**	**5911; 5912; 5913; 5914**	**5911; 5912; 5913; 5914**	Photographers and audio-visual equipment operators (3434)	**3431;3521; 3435**	**3431; 3521; 3435**
	Photographic activities	**25%**	**7420**	**7420**			

	(74.20);						
	Reproduction of video recording (18.20)	**10%**	**1820**	**1820**			
13. TV and Radio	Radio broadcasting (60.10); Television programming/ broadcasting activities (60.20)	**100%**	**6010; 6020**	**6010; 6020**	Broadcasting associate professionals (3432); TV, Video and Audio engineers (5244)	**3522; 3521**	**3522; 3521**
9&10. Music and the Visual & Performing Arts	Sound recording and music publishing activities (59.20);	**100%**	**5920**	**5920**	Musicians (3415); Actors, entertainers (3413); Dancers and choreographers (3414); Authors, writers (3412); Arts officers, producers and directors (3416)	**2652; 2655; 2653; 2641; 2654; 2656**	**2652; 2655; 2653; 2641; 2654; 2656**
	Reproduction of sound recording (18.20);	**10%**					
	Performing arts (90.01); Support activities to performing arts (90.02); Artistic creation (90.03); Operation of arts facilities (90.04)	**100%**	**9000**	**9001; 9002; 9003; 9004**			
11. Publishing	Book Publishing (58.11); Publishing of newspapers (58.13); Publishing of journals and periodicals (58.14); Other publishing activities (58.19); News agency activities (63.91)	**100%**	**5811; 5812; 5813; 5819; 7490; 6391; 6399**	**5811; 5812; 5813; 5814; 5819; 7430; 6391; 6399**	Journalists, newspaper and periodical editors (3431); Originators, compositors and print preparers (5421); Printers (5422); Bookbinders and Print finishers (5423); Screen Printers (5424)	**2642; 2643; 7321; 7322; 7323**	**2642; 2643; 7321; 7322; 7323**
8&12. Software & Electronic Publishing **8&12. Digital & Entertainment Media**	Business and domestic software development (62.01/2); Computer consultancy activities (62.02); Other software publishing (58.29); Publishing of computer games (58.21); Ready-made interactive leisure and entertainment software development (62.01/1)	**100%**	**5820; 6201; 6202; 6209**	**5821; 5829; 6201; 6202; 6203; 6209**	Information and Communication Technology managers (1136); IT strategy and planning professionals (2131)	**2511; 2512; 2513; 2514; 2519; 2521; 2522; 2523; 2529; 1330**	**2511; 2512; 2513; 2514; 2519; 2521; 2522; 2523; 2529; 1330**

Note: The selection of codes is of the responsibility of the present paper's authors, according to their interpretation of DCMS (2010a: 18, 24) selection of industrial (UK SIC 2007) and occupational (UK SOC 2000) codes. DCMS (2010a) "Creative Industries Economic Estimates – December 2010 (Experimental statistics) - Full Statistical Release", available online at: https://www.gov.uk/government/publications/creative-industries-economic-estimates-december-2010-experimental-statistics [accessed September 2014].

Despite the challenges that the combination of data on industries and occupations brought to the mapping exercise and the respective estimations, this approach proposes a richer perspective of the creative employment by extending the analysis beyond the core creative sectors to include the creative employment existing across all the non-creative sectors of the economy.

4. Computing the magnitude of the creative employment according to the existing methodological approaches

The data was extracted from *Quadros de Pessoal*, the Matched Employer-Employee Databases of the GEE/ ME[18], Ministry of Economy of Portugal, for 2009 (the latest available at the time of this study). It covers all the employment in industries and establishments operating in the national territory with at least one employee. It excludes Public Administration and Domestic services and does not account for self-employment. According to the latest information available (2009), the total employment in the private, structured sector was 3.128.126 workers.

Before proceeding with the estimations, two points are worth mentioning regarding the exclusion from the analysis of self-employed and public servants (government employees who work in any of the departments of a state or territory government).

Some studies report (e.g., Van Steen and Pellenbarg, 2012) that self-employment contributes significantly to creative employment, most notably in the most developed countries, as many of self-employed are freelance workers in sectors such as construction, consultancy, and culture, sports and recreation. In these latter countries, however, the share of self-employed workers in the total is much lower than in less developed countries.

According to the OECD, in 2010, that share ranged from under 8% in the United States, and Norway to well over 30% in Greece, Mexico, and Turkey. In Portugal that figure was approximately 20%, with more than 80% of self-employed concentrated in the primary and tertiary sectors.[19] Noticeable, according to this data, there is a trend, since 1990, for a decrease in the share of self-employed workers in the generality of countries regardless of their development level.

The exclusion of self-employment from the analysis is regrettable and important. However, as we are estimating the magnitude of the creative employment for one single country (Portugal), this exclusion does not substantially bias the analysis. That would not be the case if the analysis involved cross-country comparisons.

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[18] Courtesy of the GEE/ ME - *Gabinete de Estratégia e Estudos* of the Ministry of Economy of Portugal, October - December 2011. The GEE/ ME is not responsible for the results and interpretation contained in this study. These are of the authors' full responsibility.

[19] Data gathered from the OECD Fact Book 2011-2012: http://www.oecd-ilibrary.org/sites/factbook-2011-en/07/01/04/index.html?itemId=/content/chapter/factbook-2011-61-en and from Eurofound 2009: http://www.eurofound.europa.eu/comparative/tn0801018s/pt0801019q.htm [accessed September 2014].

Some bias has also to be acknowledged by the fact that we are excluding from the analysis public servants. Such exclusion is likely to substantially (and negatively) impact on the magnitude of creative employment, particularly when we use Florida's original proposal, which encompasses a large amount of occupations (e.g., Legislators, Administration professionals, Health professionals, Regulatory government associate professionals), which in some countries, namely in Portugal, are performed within the public sector sphere. However, when we focus the analysis of the magnitude of the creative employment on the (super) creative core, this bias is negligible.

All the estimated figures have been extracted using STATA 11® statistical analysis software. The stage at which we proceed to the estimates was also a challenge to this research work, given the limitations of the SOC system that was used to extract the data available for the year 2009 from the employment datasets.[20] The conversion of all the CPP2010 occupational codes into the previous version of CNP94 was based on the instructions in the official report by INE (2010: 460-474) on the Portuguese Classification of Occupations 2010. The codes and descriptions using the previous nomenclature - CNP94, at 6-digit level, were extracted, code by code, from the Statistics Portugal (INE) official website.

The estimates of the Portuguese creative employment, using each approach described and mapped in Section 3, are summarized in Figure 2.2.

Occupational approaches based purely on the analysis of occupational/ SOC categories and following Florida's (2002) taxonomy, led to more inflated results than those obtained by using simple industry-based/ SIC or combined industry-occupational/ SIC-SOC approaches. Accordingly, the Portuguese creative employment ranges between

[20] At the time the estimations were undertaken - from October to December 2011 - the nomenclature in use to extract 2009 data was still the previous version of occupational codes corresponding to the *CNP94* (*Classificação Nacional de Profissões - 1994*). Besides facing the already known difficulties related to more obsolete classification systems - the lack of information/*SOC* codes on the different categories of *Designers*, or the unavailability of occupational codes which were non-existent or not relevant at the time of that previous revision (e.g., Graphic designer, Interior designer, Survey and market research interviewer) - this constraint also required the exhaustive and time-consuming task of converting all the CPP2010 codes at 5 digits that were used in the mapping into the previous CNP94 codes at the maximum detail level of 6 digits, in order to capture the most precise information possible. Indeed, in order to achieve the best correspondence possible between the latest occupational revision CPP2010 and the previous nomenclature for occupations CNP94, it was necessary to look into the detail of 6-digit codes, in every single case.

17.8% and 30.8% of the total employment in the first case, and between 2.5% and 5.9% in the second.[21]

Specifically, using the industry-based/ SIC approach associated with the traditional DCMS model, the estimates for the Portuguese creative class amount to a fairly small figure of 2.5% of the total employment. Recall that this approach only takes into account the employment within the selective core of creative sectors, and with the application of portions of codes to extract the creative labour in those sectors.

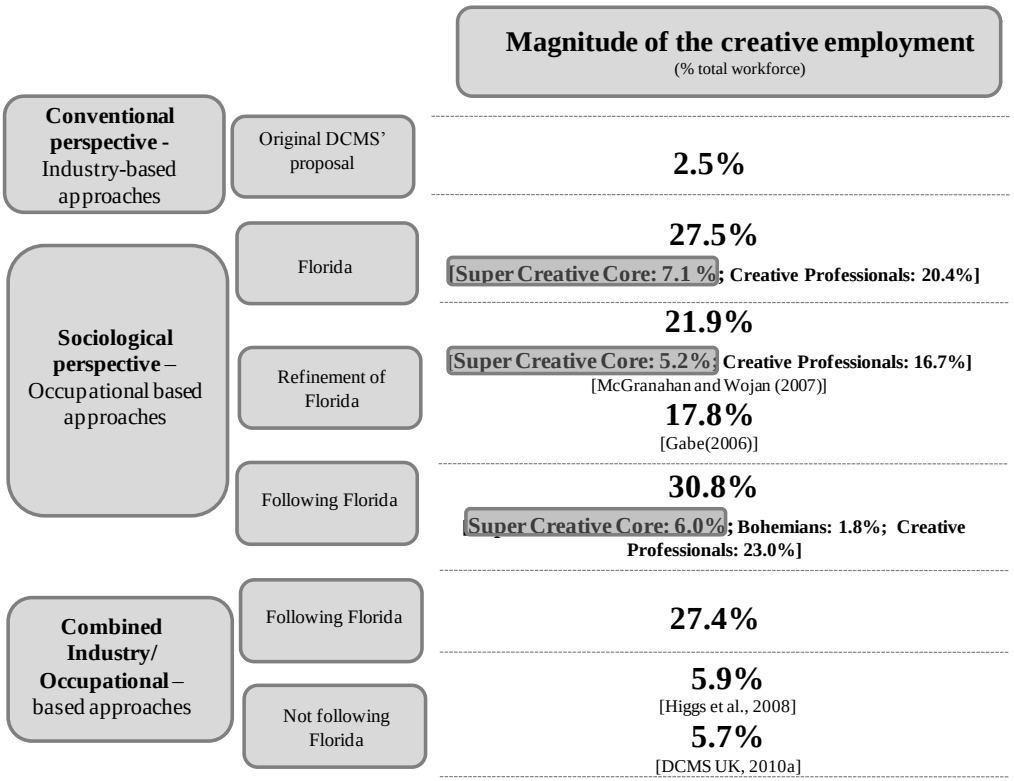

Figure 2. 2: The magnitude of the creative employment in Portugal according to the main measurement perspectives and approaches

The two of the most recent approaches that combine industry and occupational data in terms of a SIC-SOC matrix - Higgs *et al.* (2008) and DCMS (2010a) - consider the creative workers operating inside the creative industry sectors, the support workers in those creative industries, and the creative employment that can be detected across all the

[21] It is worth mentioning that in the microeconomic dataset we are using workers that are linked with more than one employer and workers with multiple records represent less than 3% of the whole dataset. When using combined industry and occupational-based approaches using this type of micro data at a rather disaggregated level on the occupational codes, only those considered as creative occupations are taken into account in the calculation. In this case, we are dealing with about 7% of the whole dataset (which encompasses 3.128.126 workers), corresponding to the measure of the creative employment for the combined approaches. Thus, the number of potential multiple records for each worker is even more negligible, below 0.5%.

non-creative industry sectors of the economy. Using these two approaches we reach similar figures for the Portuguese creative employment, approximately 6% (creative trident - 5.9%, and DCMS - 5.7%). These estimates are higher than those of the purely industry-based/SIC approaches since, as referred earlier, these combined methodologies take account of all the creative workers working outside the creative industries, in addition to those operating in these sectors.

At the other extreme, under the sociological perspective, when we use Florida's original proposal, the estimate for the Portuguese creative employment reaches 27.5% of total employment (with the 'Super creative core' accounting for 7.1% and the broad group of 'Creative professionals' 20.4%).

The proposals that closely follow that of Florida's (Boschma and Fritsch, 2009; Fritsch and Stuetzer, 2009; Mellander *et al.*, 2010), also provide rather inflated estimates for the creative employment. According to these proposals, creative employment in Portugal represented, in 2009, about one third of total employment. This figure exceeds that obtained using Florida's (2002) original proposal since the authors included the 'Administrative associate professionals' in their broad category of 'Creative professionals', whereas for Florida these occupations appear in the non-creative 'Service class'.

Considering the estimates associated with the proposals refining Florida's original contribution (Gabe, 2006; McGranahan and Wojan, 2007), the figure for the creative employment in Portugal comes smaller (respectively 17.8% and 21.9%). In their refined measure, McGranahan and Wojan (2007) excluded the vast categories of 'Health professions', 'Legal workers' and 'Teaching occupations' that were considered by Florida (2002) and which they considered to be less creative, based on the *O*NET* database criteria. The results obtained using Gabe's (2006) approach evidence, nevertheless, that if we exclude all the 'Management occupations' from the global estimate this would lead to a share of 7.6%, not very far from the one obtained for the 'Super creative core' (7.1%) using Florida's (2002) original approach, or from the figures (around 6%) for the creative employment generated by the combined industry-occupation approaches.

5. Concluding remarks

Albeit creative class and industries encompass key portions of many national economies, the size of this portion varies depending upon whether one defines the creative industries/ occupations and the resulting creative economy, widely or narrowly. These definitions, in turn, determine which industries/ occupations within systems of statistical nomenclature are included, and which are not. All the methodologies are built upon typologies of similarities and differences, and rely on rules that when pushed to their limit, become arbitrary means of delineating boundaries. Besides, it is perceptible that similar systems of statistical nomenclature, across countries, do not match when the definitions of creative industries and creative class are closely scrutinized. Indeed, reducing any complex system (e.g., the economy) to a few key concepts makes it tractable but the price of this simplification is the loss of detail, and the magnification of fairly obscure differences. Notwithstanding these pitfalls, the creative industries and creative class are useful even if imprecise concepts because, as emphasized by Boggs (2009), they help researchers understand the dynamic system that is the contemporary economy.

Besides resorting to distinct measurement methodologies, estimations and comparisons of the creative employment are often undertaken using disparate databases, information on distinct countries or regions, and covering different periods of reference. This opacity and vagueness is likely to undermine the provision of useful public policy guidance (Reese *et al.*, 2010).

The present article presented a comprehensive mapping of the existing methodological approaches, developed to measure and quantify the creative employment. Based on a unique data source, encompassing more than 3 million Portuguese employees from the private sector, the weight of the creative employment was estimated, it being possible to assess the differences in the magnitude of the creative employment conveyed by each of the existing methodologies.

Due to the conception on what creative employment is and what industries and occupational groups to consider in creative industries and/or classes, the distinct perspectives and approaches for measuring the creative employment generate, as expected, distinct figures. These ranged from a quite low figure (2.5%) when using the conventional DCSM industry-based approach to rather inflated values (from 17.8% to

30.8%) when applying the sociological perspective and the associated occupational-based approaches.

It is, however, interesting to note that if we consider the (super) creative core instead of the overall creative employment as the reference concept, the differences between the mapped methodological approaches become much less pronounced, with a mean value of 6%. This reflects the fact that at both theoretical and operational levels much more agreement exists among the distinct measurement approaches on what stands at the 'core' of the creative employment.

Based on this outcome, and as a way to mitigate the potential bias and inconsistencies in international and regional comparisons of the creative employment, we suggest that such comparisons would benefit from using the (super) creative core employment as reference concept instead of that of overall creative employment.

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Annex 2

Table A2. 1: Taxonomy following Florida's 'Creative Class' - Occupational categories

Creative Class **category groups**	**Occupational Categories Descriptions**	**Occupational ISCO-08 Codes (summary categories) / Portuguese Standard Occupational codes CPP - 2010 (summary categories)***
Super Creative Core	. Computer and mathematical occupations; . Architecture and engineering occupations; . Life, physical and social science occupations; . Education, training and library occupations; . Arts, design, entertainment, sports and media occupations	. Computing professionals (25); . Mathematicians, Statisticians and related professionals (212); . Architects, Engineers and related professionals (214; 215; 216); . Life Science professionals (213); . Physicists, Chemists and related professionals (211); . Social Science and related professionals (263); . University and higher education teachers (231); . Vocational, technological and artistic education teachers (232); . Secondary and basic education teachers (233); . Primary school and early childhood teachers (234); . Other teaching professionals (235); . Archivists, museum curators and related information professionals (262) + ***Bohemians*** . Authors, journalists and linguists (264); . Creative and performing artists (265); . Product and garment designers (2163); . Graphic and multimedia designers (2166); . Musicians, singers and composers (2652); . Dancers and choreographers (2653); . Film, stage and related directors and producers (2654); . Actors (2655); . Announcers on radio, television and other media (2656); . Creative and performing artists not elsewhere classified (2659); . Advertising and marketing professionals (2431); . Public relations professionals (2432); . Artistic, Entertainment and Sports associate professionals (342; 343); . Telecommunications and broadcasting technicians (352); . Fashion and other models (5241).
Creative Professionals	. Management occupations; . Business and financial operations occupations; . Legal occupations; . Healthcare practitioners and technical occupations; . High-end sales and sales management; . Administrative associate professionals	. Legislators, senior officials and managers (1); . Finance professionals (241); . Administration professionals (242); . Financial and mathematical associate professionals (331); . Sales and purchasing agents and brokers (332); . Business services agents (333); . Legal professionals (261); . Health professionals (except nursing) (221; 223; 224; 225; 226); . Nursing and midwifery professionals (222); . Nursing and midwifery associate professionals (322); . Life science technicians and related associate professionals (314); . Medical and pharmaceutical technicians and health associate professionals(321; 323; 324; 325); . Physical and engineering sciences technicians (311; 312; 313; 315); . Information and communications technology operations and user support technicians (351); . Regulatory government associate professionals (335); . Finance and sales associate professionals (2433; 2434); **. Administrative, legal, social and specialized secretaries and related professionals (334; 3411; 3412)**

Sources: Adapted from Boschma and Fritsch (2009). The selection of codes is from the responsibility of this article's authors as a result of their interpretation on the category groups and respective descriptions.
Note: * The detailed mapping at a 5-digit level can be provided upon request to the authors.

Table A2. 2: Refinements of Florida's proposal by McGranahan and Wojan (2007)

***Creative Class* category groups**	**Occupational Categories Descriptions**	**Occupational ISCO-08 Codes (summary categories) / Portuguese Standard Occupational codes CPP - 2010 (summary categories)***
Super Creative Core	. Computer and mathematical occupations; . Architecture and engineering occupations; . Life, physical and social science occupations; . Higher education and library occupations; . Arts, design, entertainment, sports and media occupations.	. Computing professionals (25); . Mathematicians, Statisticians and related professionals (212); . Architects, Engineers and related professionals (216; 214; 215); . Life Science professionals (213); . Physicists, Chemists and related professionals (211); . Social Science and related professionals (263); . University and higher education teachers (231); . *Vocational, technological and artistic education teachers (232) - ELIMINATED* . *Secondary and basic education teachers (233) - ELIMINATED* . *Primary school and early childhood teachers (234) - ELIMINATED* . *Other teaching professionals (235) - ELIMINATED* . Archivists, museum curators and related information professionals (262). + ***Bohemians*** . Authors, journalists and linguists (264); . Creative and performing artists (265); . Product and garment designers (2163); . Graphic and multimedia designers (2166); . Musicians, singers and composers (2652); . Dancers and choreographers (2653); . Film, stage and related directors and producers (2654); . Actors (2655); . Announcers on radio, television and other media (2656); . Creative and performing artists n.e.c. (2659); . Advertising and marketing professionals (2431); . Public relations professionals (2432); . Artistic, Entertainment and Sports associate professionals (342; 343); . Telecommunications and broadcasting technicians (352); . Fashion and other models (5241).
Creative Professionals	. Management occupations; . Business and financial operations occupations; . Legal occupations; . Drafters, engineering and mapping associate professionals; . Supervising managers and process control technicians; .Finance and sales associate professionals	. Legislators, senior officials and managers (1); . Finance professionals (241); . *Administration professionals (242) - ELIMINATED* . *Financial and mathematical associate professionals (331) - ELIMINATED* . Sales and purchasing agents and brokers (332); . *Business services agents (333) - ELIMINATED* . Legal professionals (261); . Physical, engineering and mapping technicians, and drafters (311); . Supervising managers and process control technicians (312; 313; 315); . Information and communications technology operations and user support technicians (351); . *Health professionals (except nursing) (221; 223; 224; 225; 226) – ELIMINATED* . *Nursing and midwifery professionals (222) - ELIMINATED* . *Nursing and midwifery associate professionals (322) - ELIMINATED* . *Life science technicians and related associate professionals (314) - ELIMINATED* . *Medical and pharmaceutical technicians and health associate professionals(321; 323; 324; 325) - ELIMINATED* . *Regulatory government associate professionals (3359) - ELIMINATED* . Finance and sales associate professionals (2433; 2434).

Source: The selection of codes is of the responsibility of the present paper's authors, according to their interpretation of McGranahan and Wojan's (2007: 205) refinement approach, based on the *US O*NET* database of occupations, available online at: http://www.onetcodeconnector.org/find/family/code?s=11 [accessed September 2014].

Table A2. 3: Refinements of Florida's proposal by Gabe (2006)

Creative Class **category groups**	**Occupational Categories Descriptions**	**Occupational ISCO-08 Codes (summary categories) / Portuguese Standard Occupational codes CPP - 2010 (summary categories)***
Creative Core	. Computer specialists and mathematical science occupations	. Computing professionals (25); . Mathematicians, Statisticians and related professionals (212)
	. Architects, surveyors, and cartographers; Engineers;	. Architects, Engineers and related professionals (216; 214; 215)
	. Life, Physical, Social scientists and related workers	. Life Science professionals (213); . Physicists, Chemists and related professionals (211); . Social Science and related professionals (263)
	. Post-secondary teachers . Primary, secondary, and special education school teachers . Other teachers and instructors . Librarians, curators, and archivists	. University and higher education teachers (231); . Vocational, technological and artistic education teachers (232) . Secondary and basic education teachers (233) ; . Primary school and early childhood teachers (234) ; . Other teaching professionals (235); . Archivists, museum curators and related information professionals (262)
	. Art and design workers . Entertainers and performers, sports, and related workers; Media and communication workers	Authors, journalists and linguists (264); . Creative and performing artists (265); . Product and garment designers (2163); . Graphic and multimedia designers (2166); . Musicians, singers and composers (2652); . Dancers and choreographers (2653); . Film, stage and related directors and producers (2654); . Actors (2655); . Announcers on radio, television and other media (2656); . Creative and performing artists not elsewhere classified (2659); . Advertising and marketing professionals (2431); . Public relations professionals (2432); . Artistic, Entertainment and Sports associate professionals (342; 343); . Fashion and other models (5241).
	. Media and communication equipment workers	. Information and communications technology operations and user support technicians (351); . Telecommunications and broadcasting technicians (352)
	. Top Executives/ Advertising, marketing, promotions, public relations, and sales managers/ Operations specialties managers/ Other management occupations	. Legislators, senior officials and managers (1); . *Finance professionals (241) - ELIMINATED* . *Administration professionals (242) - ELIMINATED* . *Financial and mathematical associate professionals (331) - ELIMINATED* . *Sales and purchasing agents and brokers (332) - ELIMINATED* . *Business services agents (333) - ELIMINATED* . *Legal professionals (261) - ELIMINATED* . *Physical, engineering and mapping technicians, and drafters (311) - ELIMINATED* . *Supervising managers and process control technicians (312; 313; 315) - ELIMINATED* . *Health professionals (except nursing) (221; 223; 224; 225; 226) – ELIMINATED* . *Nursing and midwifery professionals (222) - ELIMINATED* . *Nursing and midwifery associate professionals (322) - ELIMINATED* . *Life science technicians and related associate professionals (314) - ELIMINATED* . *Medical and pharmaceutical technicians and health associate professionals(321; 323; 324; 325) - ELIMINATED* . *Regulatory government associate professionals (3359) - ELIMINATED* . *Finance and sales associate professionals (2433; 2434) - ELIMINATED*

Note: The selection of codes is of the responsibility of the present paper's authors, according to their interpretation of Gabe's (2006: 398, 400-401) refinement approach, based on the US O*NET database of occupations, available online at: http://www.onetcodeconnector.org/find/family/code?s=11 [accessed September 2014].

ESSAY 3

The neglected heterogeneity of spatial agglomeration and co-location patterns of creative employment: Evidence from Portugal

The neglected heterogeneity of spatial agglomeration and co-location patterns of creative employment: Evidence from Portugal [*]

Abstract

Empirical literature on the geographic location of creative activities has been traditionally based on the spatial analysis of industries, often disregarding the creative employment that lies outside the necessarily limited boundaries of creative industries. As an extension to the most recent methodologies using industry and occupational data on industrial cluster analysis, this paper analyses agglomeration and co-location patterns of core creative activities, considering both 'embedded' (creative professionals working outside the creative sectors) and 'specialized' (creative and support professionals working in the creative sectors) creative employment. Using location quotients and principal component factor and cluster analyses, applied to all 308 Portuguese municipalities, we found that the geographical agglomeration and co-location patterns of core creative groups differ substantially. The typical arguments sustained by literature - the tendency of creative industries/ employment to agglomerate and co-locate in large metropolises - are only supported in the case of creative activities that are based on knowledge-intensive services subject to Intellectual Property Rights, namely 'Advertising/ Marketing', 'Publishing', 'TV/ Radio', and 'Software/ Digital Media', densely concentrated and co-located in developed, large urban centres, with high levels of human capital. These arguments do not hold for the traditional creative activities of 'Architecture', 'Design/ Visual Arts' and 'Crafts', which, although co-located, appear mostly dispersed with small concentrations around intermediate urban centres. 'Teaching/ training/ research' present quite dispersed geographical patterns with some clusterization around municipalities with tertiary education institutions. 'Film/ video/ photography' and 'Music/ Performing arts' show some dispersion throughout the Portuguese territory with concentration around small urban centres and in rural areas. It is evident that, from agglomeration to co-location patterns, creative employment reveals heterogeneous characteristics across creative groups.

Keywords: Spatial economics; Industrial location; Creative Industries; Portugal.

JEL codes: C01, R12, R30.

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1. Introduction

The rising interest in the creative economy has encouraged several authors both in political and academic spheres to focus on creative industries and cultural activities (DCMS, 2001; Pratt, 2006; Higgs et al., 2008; UNCTAD, 2008) and to assess their effects on regional and national development (Capone, 2008; Miguel-Molina et al., 2012).

According to several empirical studies, creative industries and creative occupations have a tendency to co-locate geographically (Capone, 2008; Lazzeretti et al., 2008, 2012) and are often associated to urban development and the growth of cities (Florida, 2002a). The uneven spatial patterns and the co-location behaviour of creative firms and creative workers are explained by territorial factors. Highly cited studies (e.g., Florida, 2002a, 2004) have shown that creative industries and workers tend to concentrate in metropolitan centres in order to take advantage of urbanization economies. The latter are provided by product differentiation, technological diversity, the geographic concentration of people, cultural diversity, and the diffusion of knowledge and innovation (Jacobs, 1969; Lorenzen and Frederiksen, 2008; Lazzeretti et al., 2008).

Despite the acknowledged role of creativity in the development of regions, the literature on the economics of location regarding creative activities is relatively scarce and recent (Boix et al., 2013).[23]

Methodologies are gradually being developed and the studies are often limited by the quality of data available in each country or region (Currid-Halkett and Stolarick, 2011; Boix et al., 2013).

In the empirical literature, there is a primary corpus of research related to industry-based studies on the geographical location of creative industries/ creative industrial clusters (e.g., Lazzeretti et al., 2008, 2012; De Propris et al., 2009; Miguel-Molina et al., 2012; Bertacchini and Borrione, 2013; Boix et al., 2013; Lazzeretti, 2013). A second strand is concerned with the geography of creative occupations and creative workers (e.g., Florida, 2002a; Florida et al., 2008; Markusen et al., 2008; Boschma and Fritsch,

[23]To have an idea, a search in the Scopus database with the keywords 'creative industries' or 'creative occupations' yielded 554 articles using these keywords in the fields 'title', 'abstract' and 'keywords'. Adding the keyword 'location' to the search only returns 37 articles (and 54 articles if the word 'geography' is added), 6% (9%) of the unrestricted search on creative industries and occupations.

2009; Hansen et al., 2009; Mellander, 2009; Clifton and Cooke, 2010; Fritsch and Stuetzer, 2012). The use of either industry-based or occupational approaches leads to differing estimations of creative employment, the most common proxy to analyse the geographical patterns of the creative economy (Markusen et al., 2008; Bertacchini and Borrione, 2013). Besides, studies based on the Standard Industrial Classification (SIC) restrict the analysis to the total employment in creative industry sectors, considering all the workers (creative and non-creative) in the same production process of the final product (the creative good), overlooking creative employment in all the non-creative activity sectors. Occupational-based methodologies, using the Standard Occupation Classification (SOC) codes, provide an inter-sectorial depiction of the creative occupational structure across the economy, but disregard the value-chain and the productive process of creative goods, where occupations, creative and non-creative, may be fundamental.

Recently, a third research path associated with methodologies that combine industry and occupational data (SIC/SOC) on the industrial analysis of creative/ cultural/ knowledge-based sectors (e.g., Barbour and Markusen, 2007; Markusen et al., 2008; Higgs et al., 2008; Currid and Stolarick, 2010a,b; DCMS, 2010, 2011, 2014; Currid-Halkett and Stolarick, 2011) has raised increasing interest as a way to overcome limitations of industry-based or occupational approaches and to provide an expanded analysis of local employment structures in the industrial spectrum across regions.

As an extension to these recent methodological perspectives, this paper provides a detailed analysis of creative employment, at a highly disaggregated regional level, using a combined industry and occupational-based approach, which accounts for creative employment across all industry sectors - creative and non-creative. It also aims at analysing the potentially disparate geographical pattern of the several sub-groups of creative employment.

The paper seeks therefore to answer the following questions:

- Do core creative industries and creative occupations tend to agglomerate?
- What are the main characteristics of the locations where creative employment tends to cluster - large metropolitan hubs, small urban centres, or rural areas?

- Do the location patterns of core creative activities differ substantially among creative groups? Do more traditional creative sectors, such as Crafts, Design and Visual arts, tend to co-locate differently from those based on intellectual property, such as Advertising and Marketing, Software and Digital media?

The analysis is carried out focusing on ten core creative groups: 'Advertising and marketing', 'Architecture', 'Design and visual arts', 'Crafts', 'Film, video and photography', 'TV and radio', 'Music and the performing arts', 'Publishing', 'Software and digital media', 'Teaching, training and research', in all the Portuguese territorial units (308 municipalities). The data used was extracted from the microeconomic Matched Employer-Employee Datasets, official databases from the Portuguese government, and each value was accurately obtained by programming the respective SIC and SOC code, using STATA 12.0®. This procedure avoided any potential overlapping of data.

The structure of the paper is as follows. Section 2 presents a brief review of the empirical literature on the location of creative industries and occupations. Section 3 outlines the main aspects of the methodology followed. In Section 4, the analysis of spatial patterns of agglomeration and co-location of core creative employment in Portugal is presented, and main results are discussed. Section 5 puts forward the study's major conclusions.

2. Empirical literature on the location of creative industries and occupations: a brief review

Over the past decade, the academic and political debate on industrial location has gradually come to highlight the geography of knowledge-intensive services and the clustering of 'soft innovation' and creative activities as drivers of regional growth (UNCTAD, 2008; Stoneman, 2009). Following the original study by DCMS (1998, 2001) on the mapping of creative industries in the UK, a considerable amount of case studies on creative clusters, cultural quarters or creative cities has been put forward in several regions of the developed world (e.g., Scott, 2000; Wiesand and Söndermann, 2005; Wu, 2005; Pratt, 2006; Roodhouse, 2006). These studies emphasize the importance that the clustering of creative activities has on producing agglomeration and urbanization economies (Jacobs, 1969), which contribute to the economic growth of

regions. Examples can be found in studies by Krätke (2002) on the film industry cluster in Potsdam; Bathelt (2002) on the Leipzig media cluster; Turok (2003) on the film/ television industry cluster in Scotland; Scott (2002) on the motion picture cluster of Hollywood and its global distribution chains; or Wu (2005) on the study of urban creative clusters and their relation with local higher education institutions (e.g., software, multimedia, designer fashion) (De Propris et al., 2009). More recently, Chapain et al. (2010) present an extensive mapping and case study analysis of the UK's creative clusters.

While there is a significant amount of literature on case studies, empirical studies on the spatial location of creative activities are relatively recent and scarce (Boix et al., 2013; Lazzeretti, 2013). Regional studies mapping and applying measures of spatial analysis to assess the industrial clustering of creative industries and occupations (e.g., Currid and Stolarick, 2010b; Currid and Williams, 2010; Currid-Halkett and Stolarick, 2011; Lazzeretti et al., 2012; Miguel-Molina et al., 2012; Bertacchini and Borrione, 2013; Boix et al., 2013; Lazzeretti, 2013) are rather unusual and this kind of research is at a developing stage particularly due to data availability/ processing and the quality of regional and code information at more disaggregated levels (Currid and Stolarick, 2010b; Currid-Halkett and Stolarick, 2011; Lazzeretti et al., 2012; Boix et al., 2013).

Empirical literature on the location analysis of creative/ cultural activities has developed around three main branches: i) industry-based studies on the spatial analysis of creative industries, ii) occupational-based studies on the geography of creative occupations, iii) studies using both industry and occupational data in the analysis of 'occupations-by-industry' structures across regions (cf. Table 3.1). The first branch of this literature has mostly focused on: i) mapping studies on the geography of creative industries (e.g., De Propris et al., 2009; Chapain et al., 2010; Currid and Williams, 2010; Bertacchini and Borrione, 2013); ii) the correlation between creative industries and urban growth (e.g., Kolenda and Yang Liu, 2012); iii) the analysis of location factors behind the spatial clustering of creative industries (e.g., Capone, 2008; Lazzeretti et al., 2008; Lorenzen and Frederiksen, 2008; Campbell-Kelly et al., 2010); iv) international comparisons of the geographical patterns of creative industries among different countries or regions (e.g., Lazzeretti et al., 2012; Miguel-Molina et al., 2012; Boix et al., 2013). These studies use SIC codes in the analysis of creative industry sectors and often follow the

DCMS (2001) taxonomy to define the core creative industries. Industry-based literature is restricted to industry sector databases exclusively based on the SIC nomenclature at a regional level (e.g., Lazzeretti et al., 2012; Miguel-Molina et al., 2012). Despite the fact that industry data is often more technically simple to process and more easily available, a major limitation of these industry-based empirical studies is that they are unable to account for creative employment in non-creative activity sectors.

A second strand of the empirical literature has evolved around the study of creative occupations, where a growing number of studies have been developed after Florida's (2002a, 2004, 2005) work on the 'creative class'. The increasing availability of occupational data and the popularity of Florida's concept led to the development of occupational-based approaches, extensively used in the geographical analysis of creative workers across regions or countries. On the geography of creative occupations, the research topics most often addressed are: i) distributional patterns of creative occupations across regions and/ or industry sectors (e.g., Fritsch and Stuetzer, 2009, 2012; Mellander, 2009); ii) testing Florida's (2002a) thesis on what are the main location factors attracting creative workers to a particular region (e.g., Boschma and Fritsch, 2009; Clifton and Cooke, 2010; Fritsch and Stuetzer, 2012); iii) comparative studies on the location patterns of creative workers among different countries or regions (e.g., Boschma and Fritsch, 2009; Clifton and Cooke, 2010); iv) spatial/ occupational mobility and migration behaviour of the creative class (e.g., Hansen and Niedomysl, 2009; Martin-Brelot et al., 2010; Borén and Young, 2013; Faggian et al., 2013); v) testing Florida's hypothesis on the correlation between the concentration of creative workers and regional economic growth/ urban development (e.g., Hansen et al., 2009; Lorenzen and Andersen, 2009; Krätke, 2010). The majority of these studies closely follows Florida's (2002a) methodology in their operational measure of the 'creative class'. Despite the interest of this approach, the use of occupational-based methodologies in studying creative activities is not free of disadvantages, since it does not capture fully the production process inside each creative industry sector. This approach only takes into account the perspective of the creative worker and not of the creative production process as a whole (Cruz and Teixeira, 2013).

A third branch of research is related with studies that use methodologies combining industry and occupational data on the industrial analysis of creative, cultural and

knowledge-based sectors (e.g., Barbour and Markusen, 2007; Markusen et al., 2008; Higgs et al., 2008; Currid and Stolarick, 2010a, b; DCMS, 2010, 2011, 2014; Currid-Halkett and Stolarick, 2011). The main purpose is to overcome the drawbacks of industry-based or occupational approaches and to offer an extended description of the occupational structures in the industrial analysis across regions/ metropolitan areas (cf. Table 3.1). Barbour and Markusen (2007) provide an examination of the occupational structure in innovation/ research-intensive vs mature/ market-oriented activity sectors of California metropolitan areas in comparison with the national distribution, concluding for highly differentiated work structures according to each industry and region. Markusen et al. (2008) conclude that, among all the empirical methodologies on the measurement of cultural economy, there are advantages to policy-makers in using methods that combine industrial and occupational data, which allow enriching findings on the estimations of cultural employment. Higgs et al. (2008) propose the 'Creative Trident' methodology, a combined industry and occupational-based approach providing a detailed analysis of creative employment inside and outside the core of creative industries. Alleging the need to expand the analysis of previous studies on industrial clustering, mostly focused on either industry-based or occupational methodologies, Currid and Stolarick (2010a) employ data on industries and occupations to undertake an occupational cluster analysis of the IT sector in Los Angeles. Also using data on industries and occupations to analyse the occupational-industry structure of the cultural sector in Los Angeles and New York, Currid and Stolarick (2010b) conclude for highly differentiated patterns of the cultural workforce across cities, responsible for the distinct artistic paths of each metropolis. Employing industry and occupational data at national and regional level, Currid-Halkett and Stolarick (2011) observe the relation between artistic occupations and Arts-related industries in the U.S. largest metropolitan areas, concluding that the majority of the artistic employment is dispersed through a wide range of non-artistic industry sectors. The latest reports of DCMS (2010, 2011, 2014) have also been making use of data on industries and occupations in order to estimate the creative employment within and outside the defined core of creative industries. Despite all the advantages, these recent methodologies are highly dependent on technical details, such as data availability, access to disaggregated microeconomic data, and the

appropriate treatment of SIC and SOC codes to adequately describe creative industries and occupations (Currid and Stolarick, 2010b; Currid-Halkett and Stolarick, 2011).

In the empirical literature, among the exploratory studies on the location of creative industries, agglomeration patterns have been assessed by means of simple measures of industry concentration (e.g., concentration ratio, Herfindahl index, Gini coefficient). Yet, since these measures are industry-specific and information on the region is better captured by means of specialization indexes that are territory-specific, the most common measure used to analyze industry agglomeration is the Location Quotient (LQ) (e.g., Currid and Stolarick, 2010b; Currid-Halkett and Stolarick, 2011; Lazzeretti et al., 2012; Miguel-Molina et al., 2012) (cf. Table 3.1). This ratio compares the regional employment of a particular industry with its national share (Lazzeretti et al., 2008) in order to provide information on the relative specialization of a region in a given industry/ in a particular type of labour. Due to its nature, the LQ is often considered as a proxy for the clustering of creative industries/ agglomeration economies in econometric models (e.g., Lazzeretti et al., 2012; Miguel-Molina et al., 2012).

On the analysis of co-location patterns, Pearson and Spearman/ partial correlation methods are often employed in order to assess the correlation between creative industries (e.g., De Propris et al., 2009; Chapain et al., 2010; Currid and Williams, 2010; Miguel-Molina et al., 2012), and data mining techniques such as the Principal Component Analysis (PCA) and Cluster analysis (hierarchical clustering/ non-hierarchical *k-means*) are used in order to group territorial units into clusters with common specialization patterns (e.g., Miguel-Molina et al., 2012; Bertacchini and Borrione, 2013) (cf. Table 3.1).

The most frequently used source of information is total employment in each creative industry sector. It has revealed to be more suitable than other variables, such as the number of firms/ establishments, in the measurement of the industrial concentration and of the creative industrial employment in a particular region (Higgs et al., 2008; DCMS, 2010, 2011, 2014; Currid-Halkett and Stolarick, 2011; Lazzeretti et al., 2012).

Regarding major aspects of the empirical literature on the geography of creative industries (cf. Table 3.1), studies are mainly centred on developed countries or regions (e.g., UK, Germany, Scandinavian countries, France, Spain, Italy, US, Canada,

Australia), where the availability of data and information on creative activities is higher. Industry-based studies had their origins in the UK, with the DCMS (1998, 2001) reports on creative industries. Creative occupations began to be extensively explored after Florida's (2002a, 2004) study on the US metropolitan regions. Thus, two important focal points of this literature lie in Western Europe and in the US/ Canada.

In terms of the territorial unit of analysis, three perspectives arise. In studies dedicated to international comparisons, disaggregation occurs at the level of NUTS 3 or corresponding regional units, such as functional city regions/ commuting areas/ labour market regions, in Europe (e.g., Andersen et al., 2010; Fritsch and Stuetzer, 2009, 2012), comparable to municipal city regions/ statistical metropolitan areas in the US (e.g., Clifton and Cooke, 2010). Here, difficulties arise when the country has its own functional definition for the spatial units and different levels of regional data are compared on the same grounds of correspondence (e.g., Fritsch and Stuetzer, 2009, 2012). In studies dedicated to the analysis of national patterns of agglomeration and co-location, the regional unit goes from NUTS 3 to higher levels of disaggregation (e.g., Lazzeretti et al., 2008, 2012; De Propris et al., 2009; Currid and Williams, 2010; Bertacchini and Borrione, 2013). In studies using both data on industries and occupations, the focus is particularly to examine the occupational structure by industry at the national level (e.g., Higgs et al., 2008; DCMS, 2010, 2011, 2014) or in the largest metropolitan areas (e.g., Currid and Stolarick, 2010b; Currid-Halkett and Stolarick, 2011) rather than on more disaggregated analyses at the level of the county or in terms of all the regions of the country.

Traditionally, location literature refers to the core creative industries as a homogeneous/ aggregated group of industries, sharing the same idiosyncrasies, industrial location factors, co-agglomeration behaviour and geographical distribution (e.g., Capone, 2008, Miguel-Molina et al., 2012). Yet, some recent studies have begun to distinguish them, with a separate analysis of each core creative sector (e.g., Higgs et al., 2008; De Propris et al., 2009; Chapain et al., 2010; DCMS, 2010, 2011, 2014).

Table 3. 1: An overview of recent empirical literature on the location of creative/ cultural activities

Methodological Approach	Author(s)	Regions	Industry Sectors	Occupations	Location measures | Indicators	Main empirical results	
						Agglomeration	Co-location
FOCUS on CREATIVE INDUSTRIES :: Location Analysis using SIC codes and the DCMS (2001) taxonomy	Lazzeretti et al. (2008)	. Italy . Spain (regions at high detailed level)	'Traditional creative sectors' (Publishing, Architecture, Music) vs. 'Non-traditional creative industries' (Software, Advertising, Research and development).	-	. Location Quotient (LQ) . Share of employment	✓ Largest urban centres.	-
	Lazzeretti et al. (2012)			-	. LQ	✗ Italy: more dispersed. ✓ Spain: around largest metropolitan areas (Madrid, Barcelona).	-
	De Propris et al. (2009)	. United Kingdom (regions at highest detailed level)	Each core creative sector (Advertising, Architecture, Arts and Antiques, Designer Fashion, Video/ Film/ Photography, Music/ Visual and the Performing Arts, Software/ Computer Games/ Electronic Publishing, Radio and TV)	-	. LQ . Number of firms . Pearson and Spearman coefficients (co-location/ correlation analysis)	✓ London and South East of England.	✓ Strong levels of correlation between most creative sectors.
	Chapain et al. (2010)	. United Kingdom (regions at highest detailed level)	Each core creative sector.	-	. LQ	✓ London and South East of England.	✓ i) Advertising, Designer Fashion and Software/ Computer Games/ Electronic Publishing; ii) Music/ Performing Arts, Video/ Film/ Photography, Publishing, Radio/ TV.
	Campbell-Kelly et al. (2010)	. USA (regions at 3-digit zip codes)	Software industry.	-	. LQ	✓ In a few metropolitan areas.	✓ Nearby some of its major customers/ heavy demanders.
	Currid and Williams (2010)	. USA (Los Angeles and New York City)	. Cultural industries (Art, Design, Fashion, Music, Performing, Film, Independent Artists)	-	. Global Moran's I test (agglomeration analysis) . Pearson correlation Method (co-location analysis)	✓ Cultural industries tend to agglomerate in central locations within Los Angeles and New York City.	✓ Cultural industries with stronger spatial correlations are: Performing Arts and Music// Music and Film// Art and Design// Art and Film.
	Miguel-Molina et al. (2012)	. 250 regions of Europe (Eurostat) . 24 countries in Europe	Aggregate perspective of creative industries.	-	. LQ . Correlation analysis . Cluster analysis	✓ Regions with higher concentration of creative industries // high-tech manufacturing industries // knowledge-intensive services.	✓ . Positive correlation between creative industries, services and manufacturing sectors; . Negative correlation between creative industries and low-tech/ non-creative manufacturing.
	Bertacchini and Borrione (2013)	. Italy (NUTS 3)	Content and service-oriented creative industries; Craft-based creative industries; and Industrial design activities.	-	. LQ . Cluster analysis . Spatial autocorrelation of LQ	✓ Creative and Cultural industries: cluster in the largest metropolitan areas. ✓ Craft-based and Design-intensive sectors: in non-metropolitan areas.	✓ . Content and service-based creative industries - spatially auto-correlated. . Industrial design activities// Craft industries - strong spatial correlation.
	Boix et al. (2013)	. France, Great Britain, Italy, Spain (local labour markets - LLM regions)	Traditional creative industries (Publishing; Architecture and engineering studies; Music, Film, Performing Arts) vs. Non-traditional creative industries (R&D; Software/ Computing; Advertising).	-	. LQ . Share of employment . Herfindahl, Gini and Theil indexes	✓ France, Spain: highly concentrated around the largest metropolitan areas (Paris, Madrid, Barcelona). ✓ Great Britain: around London and the South East of England. ✗ Italy - more diffused/ polycentric pattern around the centre-north of the country (Padua, Milan, Bologna, Verona, Florence, Rome).	-

(...)

	Author(s)	Regions	Industry Sectors	Occupations	Location measures | Indicators	Main empirical results	
						Agglomeration	Co-location
FOCUS on CREATIVE OCCUPATIONS :: Location Analysis using SOC codes and Florida's (2002a, 2004) taxonomy on the 'creative class'	Boschma and Fritsch (2009)	. Europe 503 regions (NUTS 3) in: Denmark, England/ Wales, Finland, Germany, the Netherlands, Norway, Sweden	-	'Creative class': Super creative core, Creative professionals and Bohemians.	. Regional share of the creative class; . Gini coefficient	✓ Finland, Norway, Denmark, Sweden: more spatially concentrated. ✗ Germany, the Netherlands, and England/ Wales: 'creative class' more dispersed.	✓ High spatial correlation of the shares of high-technology employment// creative core// creative professionals// employees with a tertiary degree.
	Clifton and Cooke (2009)	. Europe (UK, Sweden, Denmark, Norway, Finland, the Netherlands, Germany) - NUTS 3. . North American large metropolitan areas	-	'Creative class' as a whole, particularizing, then, for the Super Creative Core and Bohemians.	. LQ	✓ UK, Netherlands: 'creative class' more spatially concentrated. Norway, Denmark, Finland, Sweden: 'creative class' less evenly distributed than in Germany. ✗ Germany: more evenly distributed. ✓ Bohemian index, openness and the public provision index - most significant location factors.	-
	Andersen et al. (2010)	. Denmark, Finland, Norway, Sweden - 263 functional city regions (at the level of NUTS 4 and equivalent regional units)	-	'Creative class' as a whole.	. LQ	✓ Small and large Nordic city Regions: location of 'creative class' related to Openness. Medium Nordic city regions: location of 'creative class' related to the presence of Bohemians.	-
	Fritsch and Stuetzer (2009, 2012)	. Germany (German districts)	-	'Creative class' major category groups: Super creative core; Creative Professionals; Employed Bohemians and Freelance artists.	. LQ; . Population share	✓ Berlin: Bohemians and freelance artists. Share of employed bohemians is high in cities. ✓ German medium-sized cities: highest share of the Creative Core.	-

(...)

	Author(s)	Regions	Industry Sectors	Occupations	Location measures | Indicators	Main empirical results	
						Agglomeration	Co-location
FOCUS on CREATIVE INDUSTRIES and OCCUPATIONS :: Location analysis using SIC and SOC codes	Barbour and Markusen (2007)	. California, USA (eleven metropolitan areas)	. All activity sectors (innovation/ information/ research-intensive vs mature/ market-oriented industries)	. All occupational categories except those in forestry, farming and fishing industries.	. Occupational employment by industry, by region . Employment shares; . LQ	✓ Metropolitan areas of California: higher concentration of 'managerial/ professional' and 'clerical' workers; lower shares of 'service', 'manual', 'precision' and 'sales' workers, when compared to the national share; ✓ Diversified occupational-industry structures across the eleven metro areas. - San Francisco Bay: high concentration of.high-tech/ research occupations (computer professionals, selected engineers and natural scientists; - San Jose metro area / Sillicon Valley: higher concentration of Computer/IT specialists. ✓ Innovative/ research oriented industries/ occupations: overrepresented in California regions when compared to the national distribution. ✗ Mature industries: the occuaptional mix is more similar to the national structure (e.g., services).	-
	Higgs et al. (2008)	. United Kingdom (national level)	.Core Creative Industries following DCMS (1998, 2001).	. "Creative occupations are a selection of occupations which produce creative goods or services, drawn from the UK SOC codes" (Hiigs et al., 2008: 19).	. Employment shares (in and outside the core of creative industries)	-	-
	Currid and Stolarick (2010a)	. Los Angeles metropolitan área	. Information Systems (IS)/ Information Technology (IT) industries.	. IS/ IT occupations.	. Employment shares; . LQ	✓ Los Angeles: higher share of employment in 'Network systems and Data communications Analysts', in most Management occupations and in Designers, when compared to the US IS/ IT industry employment. ✗ Los Angeles: lower share of 'Computer software engineers and Computer scientists and systems analysts'.	-
	Currid and Stolarick (2010b)	. Los Angeles and New York City metropolitan statistical areas	. Cultural Industries: Publishing industries; Motion Picture/ Video Industries; Broadcasting; Performing Arts/ Sports; Museums; Amusement/ Gambling/ Recreation industries (authors' selection).	. Cultural Occupations: Arts, Design, Entertainment, Sports, Media and Museum-related occupations (authors' selection).	. Employment shares; . LQ	✓ Clustering of artistic/ cultural industries in NY and LA, but differentiated specialization patterns: - New York: Fashion and Arts-related industries; - Los Angeles: Film and Fashion industries. ✓ Different occupational structures: - New York: higher concentration of musicians, fashion designers, writers and artists. - Los Angeles: dancers, actors and multimedia artists.	-
	DCMS (2010, 2011, 2014)	. United Kingdom (national scale)	.Core Creative Industries following DCMS (2001).	. Creative occupations inside and outside the core of creative industries and non-creative occupations in creative industries.	. Employment shares	-	-
	Currid-Halkett and Stolarick (2011)	. USA (30 largest metropolitan areas)	Artistic Industries following Currid and Stolarick (2010b).	Artistic Occupations following Currid and Stolarick (2010b).	. Employment shares; . LQ	✓ Artistic activities tend to concentrate in large cities; ✗ But artistic industries in the top 30 metros are comprised of the same occupations as that of the nation.	✗ Overall, artistic industries and artistic occupations do not co-locate.

Others discriminate between 'traditional' and 'non-traditional' creative sectors (e.g., Lazzeretti et al., 2008, 2012; Boix et al., 2013), arguing that each set of industries has distinguishing features and location patterns. Recently, Bertacchini and Borrione (2013: 141) distinguish among "content and service-oriented creative industries, craft-based creative industries and industrial design activities".

Summing up, the empirical literature on the location of creative activities is conspicuously divided into: i) studies on industries, using SIC codes to process regional data on industry sectors; ii) studies on occupations, using SOC codes to examine occupational structures across regions and countries; and iii) studies on industries and occupations, employing SIC and SOC codes to analyse the occupational structure by industry, across regions or/ and at a national scale. The present paper appears as an extension to these recent studies on industries and occupations, aiming to provide deeper insights on the location patterns of creative industries and creative employment, at a high level of regional disaggregation.

3. Methodology

In order to analyse the agglomeration and co-location patterns of creative employment, ten core creative groups were considered - 'Advertising and Marketing', 'Architecture', 'Design and Visual arts', 'Crafts', 'Film, video and photography', 'TV and Radio', 'Music and the Performing arts', 'Publishing', 'Software and Digital media', 'Teaching, training and research' - and were obtained by using both industry and occupational data. The mapping methodology used here is described in detail in Cruz and Teixeira (2013), and is summarized in Table 3.2.

Data on industry sectors and on occupations was extracted from *Quadros de Pessoal*, Matched Employer-Employee Databases from GEE/ ME (Gabinete de Estratégia e Estudos/ Ministry of Economy, Portugal), for the most recent year available at the time of this study, 2009.[24] All the figures have been thoroughly extracted using STATA

[24]According to the latest data available (2009), national employment in the private, structured sector totalled 3.128.126 workers. It covers all employment in industries and establishments operating in the national territory with at least one employee, excluding Public Administration and self-employment. Cruz and Teixeira (2013) discuss the implications of such exclusions in the estimation of core creative employment.

12.0®, which yielded valid, non-overlapping information for all (308) Portuguese territorial units, at the regional level of the municipality.

Agglomeration and co-location patterns are analyzed in terms of core creative employment, comprising 'embedded' creative employment, which includes creative professionals employed in all the sectors of the economy considered as non-creative, and 'specialized/ industrial' creative employment, which encompasses all the professionals working in the creative industry sectors.

To assess agglomeration, the location quotient (LQ) was used as the basis indicator, given its treatability and suitability as a measure of industrial concentration in a region (Lazzeretti et al., 2008, 2012; Miguel-Molina et al., 2012). The LQ is computed as follows:

$LQ_{ij} = \frac{\frac{Creative\,Employment_{ij}}{Total\,Employment_{j}}}{\frac{National\,Creative\,Employment_{i}}{National\,Total\,Employment}}$, where *i* is each group of core creative employment (*i*=1,…, 10) and *j* stands for each municipality *j* (*j*=1,…, 308).

In the analysis of co-location patterns, a Principal Component/ Factor Analysis and Cluster (hierarchical and non-hierarchical *K-means*) analyses were conducted on the LQs (used as independent variables) of each of the ten core creative groups, using the SPSS® software. These procedures served to establish groups of municipalities according to common factors of specialization in the ten core creative groups, and to reduce the 308 municipalities to a specific number of homogeneous clusters.

Finally, in order to better describe the clusters obtained, a set of indicators was gathered which were identified with four types of factors commonly associated to the agglomeration and co-location of creative activities, in literature: 1) Talent/ Human Capital (Florida, 2002a, 2004, 2005; Florida et al., 2008; Boschma and Fritsch, 2009; Clifton and Cooke, 2010; Lazzeretti et al., 2012); 2) Tolerance/ Openness (Florida, 2002a, 2004; Boschma and Fritsch, 2009; Clifton and Cooke, 2010; Fritsch and Stuetzer, 2012; Lazzeretti et al., 2012); 3) Urban agglomeration and cultural amenities (Florida, 2002b; Boschma and Fritsch, 2009; Clifton and Cooke, 2010); and 4) Urban and regional development (Florida et al., 2008; Clifton and Cooke, 2010; Miguel-Molina, 2012). Table 3.3 details the indicators selected and their respective sources.

Table 3. 2: Mapping core creative employment using Industry and Occupational codes

Core Creative Sectors	Industry sectors	Portuguese CAE – Rev. 3 Industry codes (SIC)	Creative Occupations categories	Portuguese CNP94 Ocupacional Nomenclature (SOC)
1. Advertising and Marketing	Advertising; Market research/ public opinion polling	**7311; 7312; 7320**	Sales/marketing managers; Public relations managers and professionals; Advertising/ marketing professionals; Survey and market researchers	**1233; 1234; 2419; 341505; 341510; 419090**
2. Publishing	Publishing of books, periodicals/ others; Translation/interpretation activities; Libraries/archives/ museum activities; Information service activities (news agencies)	**5811; 5812; 5813; 5814; 5819; 7430; 9101; 9102; 9103; 9104;** **6391; 6399**	Writers/ journalists; Philologists/ translators/ interpreters; Graphic arts composers; Archivists/ museum curators; Librarians	**2451; 2444; 7341; 2431; 2432; 343115**
3. Architecture	Architectural activities	**7111**	Building, landscape, town planning Architects; Cartographers/ surveyors; Draughts persons	**2141; 2148; 3118**
4. Design and Visual Arts	Design activities	**7410**	Visual artists; Designers; Decorators	**2452; 3471**
5. Crafts	No SIC codes match this category	**-**	Technicians of precision instruments; Jewelers/cutters; Potters; Glass makers/ molders/polishers; Decorative painters; Cutters/engravers of glass and ceramics; Handicraft workers in wood/basketry; Woodworkers; Handcrafters in fabric/leather; Handloom weavers; Tailors/ dressmakers/ furriers/ hatters	**3115; 7311; 7312; 7313; 7321; 7322; 7323; 7324; 7331; 7424; 7422; 7332; 7432; 7433; 7434**
6. Film, Video and Photography	Motion picture, video and television production, post-production, distribution and projection activities; Photographic activities	**5911; 5912; 5913; 5914; 7420**	Film Directors/ Producers; Assistants of scene/ film production; Photographers/equipment technicians for the recording of image and sound; Photographic developing / printing professionals; Cultural Promoters	**2455; 3131; 343120;514920; 514945; 7344**
7. TV and Radio	Radio activities; Television activities	**6010; 6020**	Speakers/ announcers of radio/television /entertainment activities; TV Producers; Technicians of audio broadcasting (radio/television/ telecommunications)	**3472; 121040; 311410; 311490; 313205; 313290**
8. Music/ Entertainment and the Performing Arts	Sound recording/music publishing activities; Performing arts; Support activities to performing arts; Artistic and literary creation; Operation of arts facilities; Amusement/ recreation activities	**5920; 9001; 9002; 9003; 9004; 9321/9**	Actors; Composers/musicians/singers; Dancers; Choreographers; Restaurant/ Cafeteria Chefs	**245510; 2453; 3473; 2454; 514950; 512105; 512205**
9. Software and Digital Media	Software publishing; Computer programming/ consultancy; Data processing/hosting/Web portals	**5821; 5829; 6201; 6202; 6203; 6209; 6311; 6312**	Computer systems professionals; Computing programmers; Directors of computing /IT; Computing/ IT technicians	**2131; 3121; 1236; 3122**
10. Teaching, training and research	Research on natural sciences, engineering, social sciences and humanities	**7211; 7219; 7220**	Physicists/ Chemists; Mathematicians/ Statisticians; Life science professionals; Secondary/ Higher education teachers; Social/ Human sciences professionals	**211; 212; 221; 23; 244**

Table 3. 3: Indicators associated with creative activities' literature, that were selected to describe the clusters of municipalities

Group/ type	Indicator	Indicator computation	Source
Talent/ Human Capital [Florida (2002a, 2004, 2005), Florida et al. (2008), Boschma and Fritsch (2009), Clifton and Cooke (2010), Lazzeretti et al. (2012)]	Proportion of population with completed tertiary education	Resident population with 21 and more years old with complete tertiary education, in total resident population with 21 and more years old	INE, National Statistics. Census 2001.
	Gross enrolment rate in upper secondary education	Pupils enrolled on upper secondary education in total resident population aged between 15 and 17 years old	INE, National Statistics. Reference period: 2010-2011
	Proportion of professionals socially more valued	Proportion of employed population in the occupational categories of 'Representatives of legislative/executive bodies/officers/directors/executive managers' or of 'Specialists of intellectual and scientific activities' in total employed population	INE, National Statistics. Reference period: 2011.
Tolerance/ Openness [Florida (2002a, 2004), Boschma and Fritsch (2009), Clifton and Cooke (2010), Fritsch and Stuetzer (2012), Lazzeretti et al. (2012)]	Foreign population	Number of foreign individuals who have applied for resident status per 100 inhabitants	INE, National Statistics. Reference period: 2007.
	Social inequality ratio	Calculation based on the weight of each socioeconomic group in the municipality's population	INE, National Statistics. Reference period: 2001.
	Total (regional) Attraction Rate	Proportion of resident population that 5 years before inhabited in another territorial unit or another country in total resident population in the territorial unit	INE, National Statistics. Reference period: 2011
Urban agglomeration and cultural amenities [Florida (2002b), Boschma and Fritsch (2009), Clifton and Cooke (2010)]	Population's density	Number of individuals per square kilometer	INE, National Statistics. Reference period: 2011.
	Firms' density	Number of firms per square kilometer	INE, National Statistics. Reference period: 2010.
	Museums/ zoological/ botanic gardens/ aquariums	Number by geographic localization	INE, National Statistics. Reference period: 2011.
	Rooms/ spaces of live shows and performances	Number by geographic localization	INE, National Statistics. Reference period: 2011.
Urban and regional development [Florida et al. (2008), Clifton and Cooke (2010), Miguel-Molina (2012)]	Employment polarization index	Employed population in the territorial unit/ Employed resident population in the territorial unit	INE, National Statistics. Census 2011.
	Proportion of purchasing power by geographic localization	Index of Purchasing Power (Portugal=100) weighted by each municipality's population weight (municipality's population/ national population)	INE, National Statistics. Reference period: 2009.
	Average monthly earnings (euros)	Average monthly amount in Euros (per worker) by geographic localization	INE, National Statistics. Reference period: 2009.

4. Agglomeration and co-location of core creative employment in Portugal: results

4.1. Agglomeration of creative employment in each core creative group

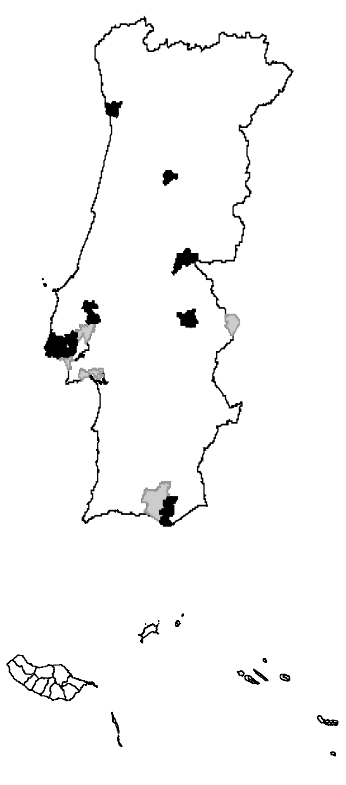
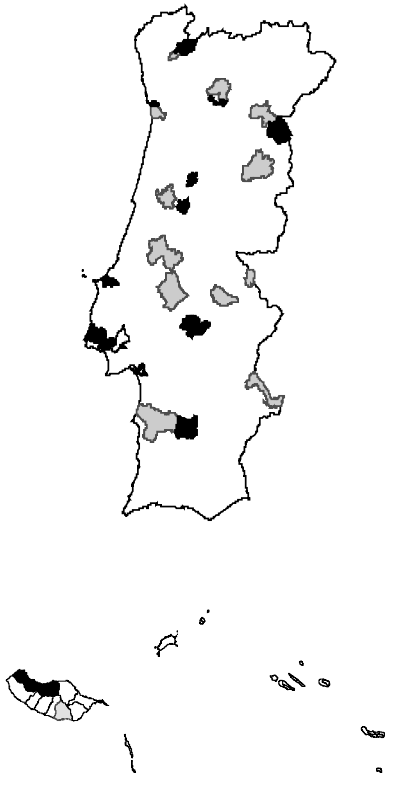
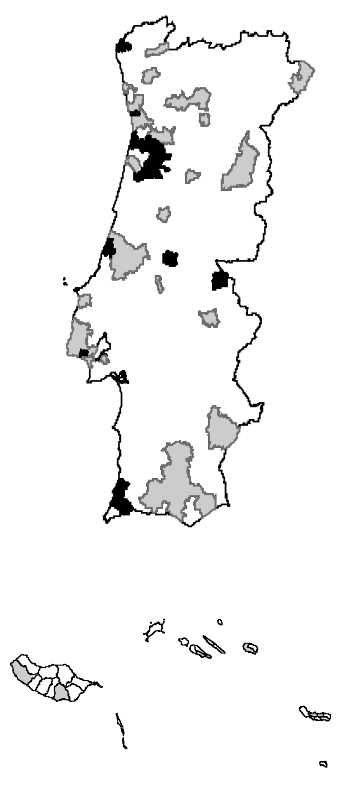
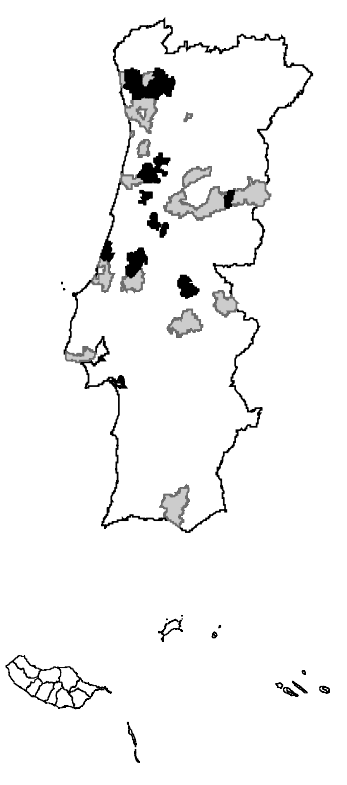
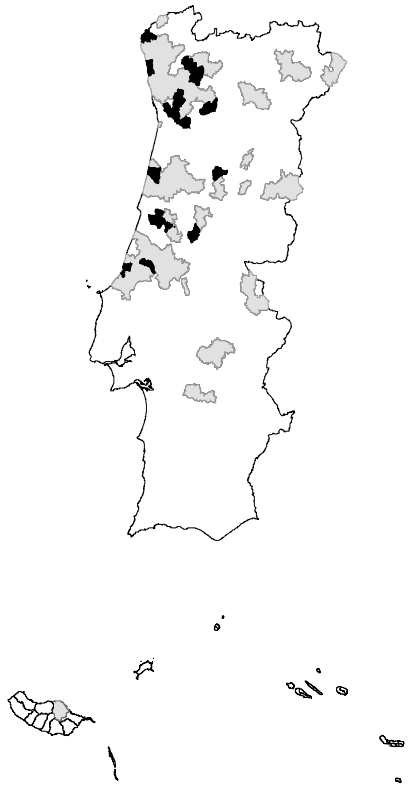
The analysis of the location quotient for each creative group and its spatial visualization indicates that the geographical patterns of core creative employment differ substantially among the ten groups of core creative sectors considered (see Figure 3.1).

Specifically, 'Advertising and marketing', 'Publishing', 'TV and radio', and 'Software and digital media' tend to agglomerate around the largest/ most important urban centres, notably the largest Portuguese cities, Lisbon (the capital) and Porto, plus Oeiras, a highly populated municipality near Lisbon. In contrast, 'Teaching, training and research' present quite dispersed geographical patterns around municipalities with tertiary education (university and polytechnic) institutions (e.g., Bragança, Porto, Coimbra, Viseu, Lisboa, Évora, Beja, Faro).

'Film, video and photography' and 'Music and the performing arts' present similar geographical patterns showing dispersion throughout the Portuguese territory with some concentration around small urban centres. 'Music/ Performing Arts' are mostly found in touristic locations located in coastal areas, whereas the independent production of 'Film/ Video/ Photography' is dispersed across inland municipalities, where public festivities and social events play an important role.

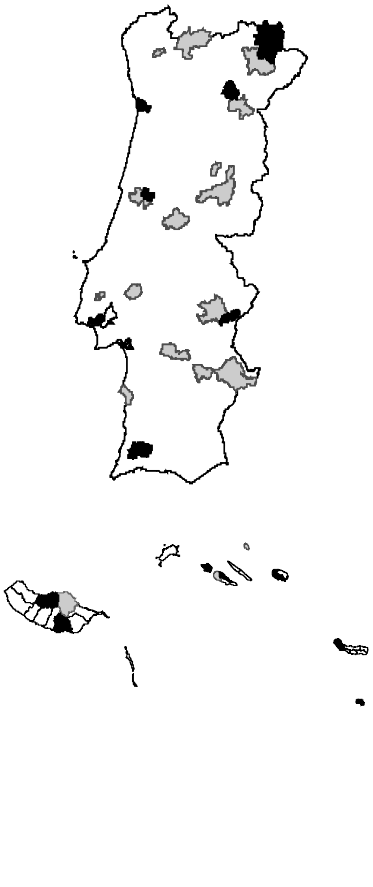
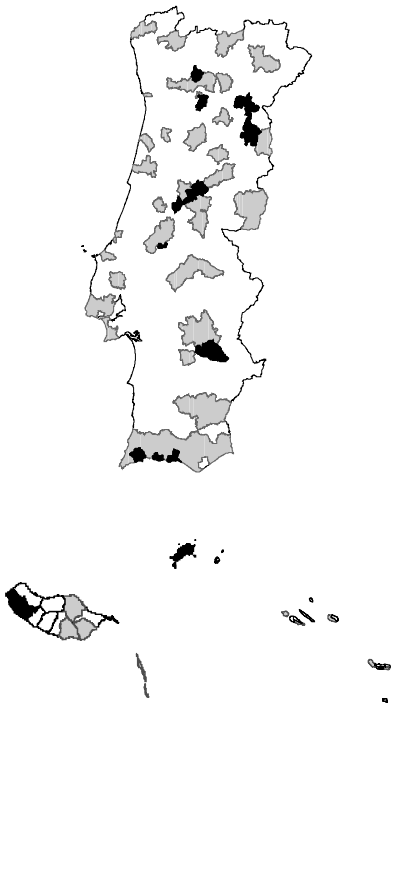
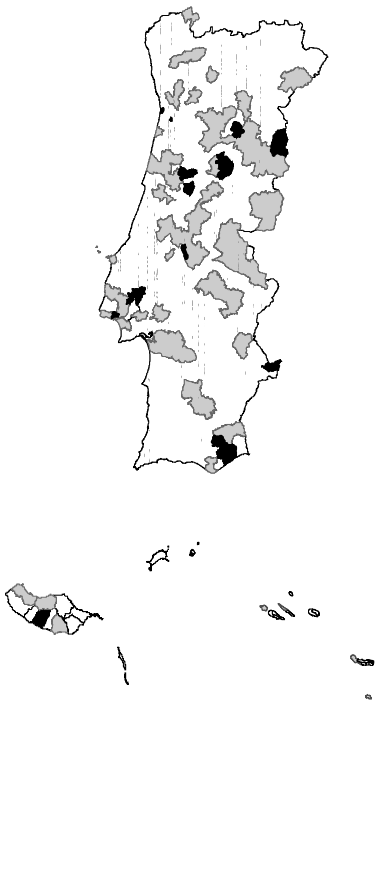
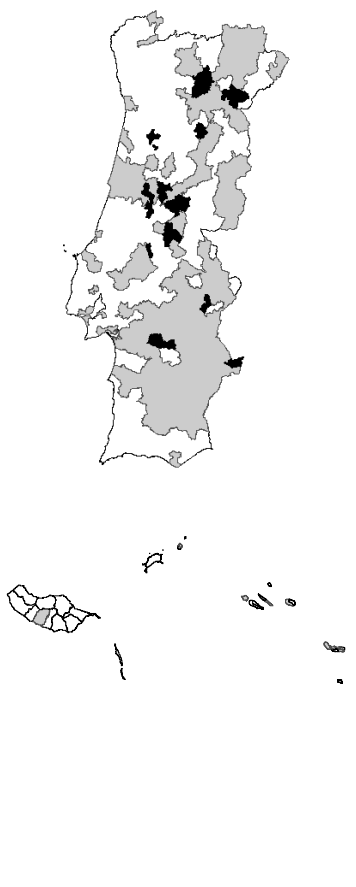
Dispersion is also a characteristic of Architecture', 'Design and visual arts' and 'Crafts', although they present some agglomeration in intermediate urban centres. Architecture has a long tradition in the school of Porto (e.g., modern architecture - Souto Moura and Siza Vieira). Design is mainly related to fashion/ industrial design activities in the textile manufacturing industries concentrated in the North of mainland Portugal. Handicraft activities are related to traditional arts and crafts particularly enrooted in the North-Centre of the country, located near sources of raw materials or where craft activities have long-standing tradition (e.g., textiles, ceramics, glass, woodcrafts, basketry): jewellery/ goldsmiths in Gondomar; woodcrafts in Paços de Ferreira; embroidery/ weaving in Fafe; tinsmithing/ ceramics/ porcelain, in Batalha; glass crafts, in Marinha Grande.

Figure 3. 1: Agglomeration patterns of Portuguese core creative groups

Advertising and Marketing	Publishing	Architecture	Design and Visual Arts	Crafts
				
Highly specialized municipalities: 15	Highly specialized municipalities: 15	Highly specialized municipalities: 15	Highly specialized municipalities: 15	Highly specialized municipalities: 15
Specialized municipalities: 5	Specialized municipalities: 15	Specialized municipalities: 44	Specialized municipalities: 34	Specialized municipalities: 54
Non-specialized municipalities: 288	Non-specialized municipalities: 278	Non-specialized municipalities: 249	Non-specialized municipalities: 259	Non-specialized municipalities: 239
✓ Concentrated in large urban centres.		✖ Dispersed across intermediate urban centres.		
Oeiras (3.43); **Lisboa** (2.28); Matosinhos (1.45); **Sintra** (1.28); **Porto** (1.22)	**Oeiras** (2.89); **Lisboa** (2.60); **Porto** (2.40); Amadora (2.24); **Sintra** (1.75)	Oliveira de Azeméis (1.93); Águeda (1.69); **Porto** (1.64); Ovar (1.52); **Oeiras** (1.52)	Barcelos (3.42); Guimarães (2.99); Vila Nova de Famalicão (2.52); Águeda (2.22); Marinha Grande (2.15)	Batalha (8.79); Gondomar (7.37); Fafe (5.37); Paços de Ferreira (5.30); Paredes (4.75)

Notes: Non-specialized municipalities are those whose Location Quotient (LQ) < 1.00; Specialized municipalities are those whose LQ is > 1.00 but lower than the value corresponding to the 95th percentile of the LQ; Highly specialized municipalities correspond to those whose LQ is above the 95th percentile of the LQ.
Source: Authors' computations based on micro-data from the Matched Employer-Employee Databases, GEE/ ME, Ministry of Economy, Portugal (2009).

Figure 3.1 (cont.): Agglomeration patterns of Portuguese core creative groups

TV and Radio	Music and the Performing Arts	Film, Video and Photography	Software and Digital Media	Teaching, training and research
				
Highly specialized municipalities: 15	Highly specialized municipalities: 15	Highly specialized municipalities: 15	Highly specialized municipalities: 15	Highly specialized municipalities: 15
Specialized municipalities: 20	Specialized municipalities: 65	Specialized municipalities: 72	Specialized municipalities: 1	Specialized municipalities: 109
Non-specialized municipalities: 263	Non-specialized municipalities: 228	Non-specialized municipalities: 221	Non-specialized municipalities: 292	Non-specialized municipalities: 184
✓ Concentrated in most important urban centres.	✗ Dispersed across small urban centres and rural areas.	✓ Concentrated in large urban centres ✗ Dispersed across small urban centres and inland/ rural areas.	✓ Concentrated in large urban centres.	✗ Very dispersed across large and intermediate urban centres.
Oeiras (6.53); Ponta Delgada (Azores Island); (4.59); **Lisboa** (3.43); Vila Nova de Gaia (3.38); Funchal (Madeira Island) (2.48)	Pedrógão Grande (11.4); Calheta (Madeira Island) (7.11); Lagoa (6.60); Albufeira (4.54); Lagos (3.88)	Seia (3.74); V. Franca de Xira (2.74); S. João da Madeira (2.71); Espinho (2.70); **Oeiras** (2.28); Tavira (2.18)	**Oeiras** (5.72); Amadora (3.04); **Lisboa** (2.57); **Porto** (1.83); Matosinhos (1.20)	Oliveira de Frades (5.31); Beja (2.17); **Oeiras** (2.06); **Porto** (1.77); Coimbra (1.74)

4.2. Co-location of core creative employment

Considering all the ten core creative groups and based on principal component and factor analysis,[25] we estimated the latent factors able to explain the correlational behaviour among the LQs of each core creative sector and, thus, capture the co-location patterns of core creative employment.

The analysis of the Rotated Component Matrix (cf. Table 3.4) uncovered four main latent factors, which together explained approximately 57% of total variance of the original variables. Factor 1, labelled 'Intellectual Property creative employment', associates the core creative groups 'Advertising/ Marketing', 'Publishing', 'TV/ Radio', and 'Software/ Digital Media' with component 1. These activities appear co-located as they are human-capital/ knowledge-intensive activities generally dedicated to the production of intangible creative contents subject to intellectual property rights.

Table 3. 4: Co-location analysis of the ten core creative groups: estimated Rotated Component Matrix

Factors' labels	Core Creative groups Location Quotients (LQs)	**FC1**	**FC2**	**FC3**	**FC4**
IP core creative	Software/ Digital Media	**0.799**	0.230	0.055	0.151
	TV/ Radio	**0.668**	-0.127	-0.126	-0.080
	Advertising/ Marketing	**0.631**	0.286	0.181	0.141
	Publishing	**0.495**	-0.065	0.013	-0.079
Traditional core creative	Design/ Visual Arts	0.091	**0.791**	-0.138	-0.058
	Crafts	-0.222	**0.658**	0.175	-0.130
	Architecture	0.213	**0.579**	-0.082	0.187
Leisure versus Intellectual/ Mental core creative	Music/ Performing Arts	0.058	-0.163	**0.809**	0.171
	Teaching/ Training/ Research	0.008	-0.158	**-0.605**	0.459
Independent/ freelance core creative	Film/ Video/ Photography	-0.019	0.026	0.049	**0.864**
Total variance explained		**19%**	**16%**	**11%**	**11%**

'Architecture', 'Design/ Visual Arts' and 'Crafts' emerge as highly correlated with component 2. We labelled factor component 2 as 'Traditional core creative' as it

[25]Factor analysis assesses the structure of a set of interrelated observed variables in order to find a low number of intrinsic/ latent factors that may partially explain the behaviour of original variables. If two variables are (not spuriously) correlated, their interdependency results from a common, not directly observable feature, *i.e.*, a latent factor (Maroco, 2011: 471).

encompasses more traditional creative activities with their co-location near sources of raw materials or in areas with long-standing tradition in architecture, fine arts and crafts.

Factor 3 opposes 'Leisure' creative employment ('Music/ Performing Arts') to 'Intellectual/ Mental' core creative employment ('Teaching/ training/ research').

Finally, Factor 4 reflects 'Independent/ freelance' core creative employment (i.e., 'Film/ Video/ Photography'), with a specific distributional pattern.

Based on the factor components obtained, we performed a cluster analysis in order to group the 308 municipalities according to similarities/ proximities in specialization. This process first involved a hierarchical cluster procedure in order to achieve an appropriate number of clusters. It was then followed by a refining method, using a non-hierarchic *k-means* cluster analysis to define the final groupings and their composition according to the number of clusters determined in the first stage.

The outcome of this process (cf. Table 3.5) revealed that 186 municipalities have no particular specialization in any of the core creative groups (Cluster 1). Cluster 2 comprises 19 municipalities with relatively high specialization in 'Leisure creative' and low specialization in 'Intellectual/ Mental' core creative activities (Factor Component 3, cf. Table 3.4).

Table 3. 5: Clusters of municipalities by core creative employment specialization

	Cluster 1 Non specialized municipalities	**Cluster 2 Leisure versus Mental core creative**	**Cluster 3 IP core creative**	**Cluster 4 Traditional core creative**	**Cluster 5 Independent/ freelance core creative**
Number (%) of municipalities	**n=186 (60%)**	**n=19 (6%)**	**n=2 (1%)**	**n=53 (17%)**	**n=48 (16%)**
REGR factor score 1	0.048	-0.024	**8.010**	-0.045	-0.459
REGR factor score 2	-0.379	-0.697	1.039	**1.670**	-0.140
REGR factor score 3	-0.138	**2.562**	-0.233	0.194	-0.683
REGR factor score 4	-0.381	0.646	1.893	-0.254	**1.421**

Cluster 3 encompasses 2 municipalities specialized in the Intellectual Property (IP) creative employment (Factor Component 1). Cluster 4 includes 53 municipalities with high specialization in Traditional creative employment (Factor Component 2). Cluster 5 groups 48 municipalities presenting relatively high specialization in 'Independent/ freelance' creative activities (Factor Component 4).

Figure 3.2 illustrates the location patterns of the 5 clusters obtained. It reveals, as expressed in Table 3.5, that a large number of Portuguese municipalities has no specialization in the ten core creative groups considered. Creative employment in Portugal tends to concentrate and co-locate in a specific, relatively reduced, number of municipalities.

The most knowledge-intensive activities, the IP core creative groups of 'Advertising/ Marketing', 'TV/ Radio', 'Software/ Digital Media' and 'Publishing', are densely agglomerated and co-located in two large urban centres - Lisbon, the Portuguese capital, and Oeiras, a high-tech municipality near Lisbon.

Traditional creative sectors are more widely distributed and co-located around intermediate urban centres in the North-Centre of the country. The northern municipalities of Porto, Braga and Guimarães are particularly specialized in the traditional sectors of textile manufacturing/ fashion design, in architecture, design and fine arts, whereas those in the Centre, such as Aveiro, Coimbra and Leiria, are known for their traditional crafts, such as ceramics, glass-making and hand-painting decoration.

'Leisure' creative activities ('Music/ Performing Arts') are mainly co-located in coastal/ tourism municipalities (south of the country; islands of Madeira and Azores) in opposition to 'Intellectual' creative employment ('Teaching/ training/ research'), widely distributed around inland cities with universities (Porto, Aveiro, Coimbra, Lisboa, Évora, Beja).

Independent/ freelance creative activities such as 'Film/ Video/ Photography' appear dispersed across small, inland municipalities where cultural festivities and social events exert high local impact.

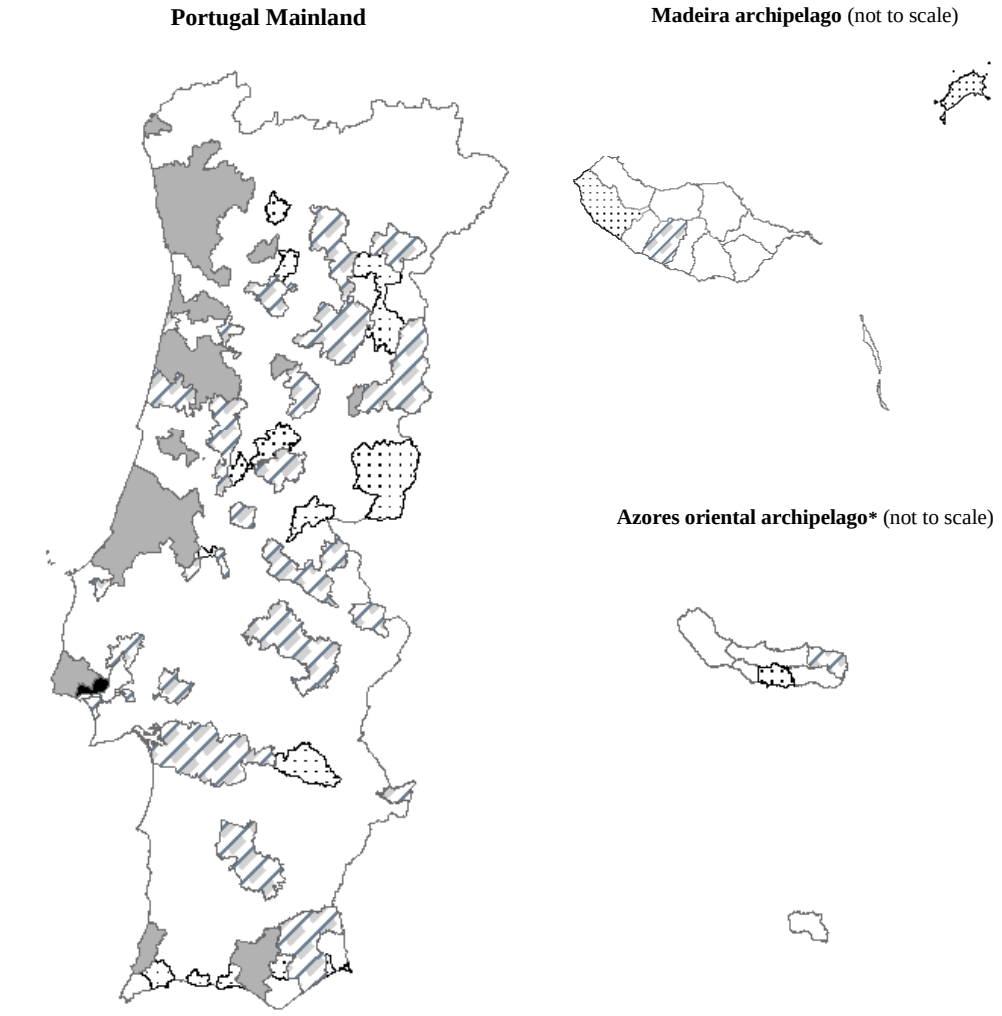


Figure 3. 2: Location patterns of core creative clusters, mainland Portugal and islands

Note: 308 municipalities grouped according to 5 clusters resulting from PCA and cluster analysis
*The remaining Azores islands were not specialized in any core creative group
Source: Authors' computations based on micro-data from the Matched Employer-Employee Databases, GEE/ ME, Portugal (2009)

4.3. Characterization of core creative clusters based on regional indicators

Indicators commonly associated with the agglomeration and co-location of creative activities (cf. Table 3.3) were added to the analysis of geographical patterns, to provide a better characterization of the 5 clusters defined in the previous section. For the indicators selected, only one, Employment polarization index, failed to discriminate the clusters analysed for the standard levels of statistical significance (1%, 5% and 10%) (cf. Table 3.6).

It is noticeable that municipalities belonging to Cluster 3 - 'IP core creative' employment - have higher levels of human capital/ talent (highest tertiary/ upper educational attainment and largest proportion of socially valued professionals), are more able to attract individuals, present a denser urban agglomeration (highest population and firm density), a larger number of cultural amenities, and are economically more developed (highest per capita purchasing power and average earnings). These traits suggest that such municipalities function as large metropolitan centres, hubs of knowledge-intensive services (e.g., media/ broadcasting, software/ digital media, technology/ high-tech consultancy) and reservoirs of human capital.

Clusters 5 and 2 stand at the opposite end, encompassing municipalities specialized in 'Independent/ Freelance' and 'Leisure core creative' employment, respectively. Both clusters are characterized by economically laggard municipalities, in general, less developed municipalities along the coast or in inland areas of the country, where seasonal touristic services and social events represent important sources of income, with low levels of human capital, population density and cultural amenities.

Two important traits distinguish these two clusters: municipalities specialized in 'Leisure creative' activities tend to be much more tolerant (as reflected by the higher figure in the foreign population who applied for resident status) than those specialized in 'Independent/ Freelance creative' employment; the latter are relatively more socially diversified.

Table 3. 6: Characterization of core creative clusters - Means Table/ Kruskal-Wallis (KW) test

	Indicators	**Cluster 1** Non specialized municipalities	**Cluster 2** Leisure vs Mental core creative	**Cluster 3** IP core creative	**Cluster 4** Traditional core creative	**Cluster 5** Independent/ freelance core creative	***KW test p-value***
Talent/ Human Capital	Proportion (%) of individuals with complete tertiary education	4.8	4.5	**21.8**	6.5	***4.2***	*0.00*
	Gross enrolment rate in upper secondary education (%)	119.1	103.9	**220.8**	124.1	***108.6***	*0.10*
	Proportion (%) of professionals socially more valued	17.2	16.0	**40.9**	19.4	***15.8***	*0.00*
Tolerance/ Openness	Foreign population who applied for resident status (%)	0.45	**1.59**	0.52	0.62	***0.36***	*0.10*
	Social Inequality/ Diversity Ratio	0.72	0.72	0.72	***0.68***	**0.73**	*0.00*
	Total (regional) Attraction Rate	7.59	9.16	**12.31**	***7.57***	7.75	*0.03*
Urban agglomeration/ Cultural amenities	Population Density (Nº/km2)	153.5	***101.8***	**5092.9**	822.1	162.9	*0.00*
	Firms' density (Nº/km2)	14.6	***11.9***	**845.8**	91.0	18.5	*0.00*
	Nº Museums/zoos/ botanic gardens/ aquariums	1.0	***0.7***	**22.0**	2.0	0.8	*0.00*
	Nº Rooms/spaces of live shows and performances	1.2	1.4	**39.0**	2.2	***0.8***	*0.00*
Urban/ regional development	Employment Polarization Index	0.92	0.95	1.72	0.91	0.94	*0.17*
	Per capita purchasing power Index	73.7	70.8	**208.9**	85.0	***69.6***	*0.00*
	Average monthly earnings (euros)	828.2	835.4	**1600.7**	872.6	***805.6***	*0.00*

Note: Grey cells identify the indicators for which the non-parametric Kruskal-Wallis test rejects the null hypothesis of similar sample means. **Bold (*italic)*** figures identify the highest (lowest) values of the means.

Although with intermediate levels of human capital and development, municipalities specialized in 'Traditional core creative' employment (Cluster 4) present the lowest social inequality ratios and attraction rates. They are mainly intermediate urban centres where social inequalities are less pronounced, when compared to regions exposed to higher immigration levels. The less attractive a municipality is in terms of newcomers/ foreigner people, the lower the levels of social inequality it will tend to present.

5. Conclusions

Do creative activities reveal a tendency to agglomerate and/ or co-locate? Do agglomerative and co-location patterns differ substantially across creative sectors? What are the main characteristics of the regions where creative activities are located? To answer these questions, the empirical literature has mostly focused on industry-based

approaches (e.g., Capone, 2008; Lazzeretti et al., 2008, 2012; Miguel-Molina et al., 2012) which are often restricted to the available data, mainly industry data at a regional level; they do not account for creative employment in non-creative sectors; and typically consider these activities as a homogeneous group, not particularizing the spatial analysis for each creative sector (Boix et al., 2013).[26]

In a context of growing interest/ debate in expanding the industrial cluster analysis with occupational-industry approaches (e.g., Barbour and Markusen, 2007; Higgs et al., 2008; Markusen et al., 2008; Currid and Stolarick, 2010a,b; Currid-Halkett and Stolarick, 2011; DCMS, 2010, 2011, 2014), this paper provides an useful extension in the topic by employing both industry and occupational data on the study of the agglomeration and co-location patterns of embedded and specialized/ industrial creative employment in all the municipalities of Portugal.

The results showed that, generally, creative activities tend to agglomerate in a reduced number of municipalities. However, the spatial analysis in each core creative group showed that the geographical patterns are clearly differentiated across the groups considered. The typical arguments sustained by the literature - the tendency of creative industries/ employment to agglomerate and co-locate in large metropolises (e.g., Florida, 2002a,b, 2004; Lazzeretti et al., 2008) - are only supported in the case of the knowledge-intensive creative groups of 'Advertising/ Marketing', 'Publishing', 'TV/ Radio', and 'Software/ Digital Media', which appear densely concentrated and co-located in large urban centres, with high levels of human capital and urban development. This is explained by their constant need for human capital, given the creative goods/ contents they produce.

Yet, these arguments no longer hold for the traditional creative groups of 'Architecture', 'Design/ Visual Arts' and 'Crafts', mostly dispersed around intermediate urban centres, near sources of raw material or in areas with long-standing tradition in architecture/ fine arts, traditional occupations and crafts. These findings are corroborated by results recently obtained by Bertacchini and Borrione (2013) and Boix et al. (2013), who

[26] A simple industry-based analysis was complementarily undertaken. It yielded modest results when compared to the present industry and occupational analysis. Data on industry/ SIC sectors only served to conclude that core creative industries' employment is agglomerated and co-located in two large urban centres: Lisbon and Oeiras.

highlight the importance of considering the specificities of each core creative sector in location studies.

'Leisure creative' activities ('Music/ Performing Arts'), understood as a catch-all measure of entertainment/ bohemian activities (Florida, 2002a), are mainly found in tourism, coastal municipalities, with a low presence of 'Intellectual/ Mental creative' activities ('Teaching/ training/ research'), which, in turn, are dispersed around university cities in inland areas of the country. These results differ from Florida's (2002a,b, 2004) popular findings. Portugal's intermediate urban development and the high concentration of leisure and tourism activities in coastal areas may help explain these outcomes. Nevertheless, our findings suggest that municipalities with a higher presence of Leisure activities are those with higher levels of tolerance. This corroborates Florida et al.'s (2008) argument that there is a positive relation between tolerance and the presence of entertainment/ artistic activities in a region.

The diversity of geographical patterns becomes evident when detailing the spatial analysis of each core creative group. From their agglomerative behaviour to co-location patterns, creative employment reveals heterogeneous characteristics across creative groups. This heterogeneity has to be appropriately acknowledged when designing and implementing policy strategies which relate creativity with regional development. Such policy measures should not be only creativity-oriented but also specific to each type of core creative group (knowledge-intensive, traditional, leisure, intellectual, independent/ freelance).

Furthermore, the results obtained allow us to conclude that the differentiated (co)location patterns of creative activities are mainly a regional phenomenon, distinguishing regions within the same country, and not only an aspect differentiating countries in international comparisons, as in Lazzeretti et al. (2012).

This study did not extend its analysis to factors behind the spatial patterns of agglomeration and co-location observed. Further research on the determinants of location would broaden our understanding of these patterns and sustain the formulation of more appropriate regional policies on creativity and regional growth. Undoubtedly, this constitutes grounds for future lines of research and further steps to be explored.

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ESSAY 4

The determinants of spatial location of creative industries start-ups: Evidence from Portugal using a discrete choice model approach

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The determinants of spatial location of creative industries start-ups: Evidence from Portugal using a discrete choice model approach

Abstract

This paper assesses the location determinants of the newly created firms in the creative sector within the framework of Discrete Choice Models. Estimations using a conditional logit model, which incorporate spatial effects of neighbouring regions in the location choices of firms, yield the following results: i) the concentration of creative and knowledge-based activities, due to agglomeration economies, play an important role in location decisions of new creative establishments; ii) in contrast, the concentration of service-business activities has a negative impact on location choices, which may be due to the fact that creative firms privilege interdependencies with other activity sectors, such as innovation/ knowledge-based activities; iii) creative firms tend to favour a diversified industrial tissue and related variety, in order to enjoy from inter-sectorial synergies; iv) higher education at a regional level has a highly significant, positive effect on location decisions, while lower educational levels of human capital negatively affect those decisions, explained by the specific requirements that creative firms usually have of a highly skilled labour force; v) tolerant/ open environments attract creative activities; vi) creative firms tend to favour municipalities where the stock of knowledge and conditions for innovative activity are higher.

Location decisions of creative firms also vary according to the creative sector they belong to and to their own characteristics, firm's educational level or technology-intensity. Finally, municipality attributes are more important in terms of firms' location decisions than the characteristics of nearby regions.

Keywords: Spatial economics; industrial location; econometric models; creative industries.

JEL codes: C01, R12, R30.

1. Introduction

It is widely documented that firms tend to co-locate and that industrial agglomeration leads to localization economies (e.g., Marshall, 1890/1920; Hoover, 1937; Krugman, 1991; Fujita and Thisse, 2002; Devereux et al., 2004; Ellison et al., 2007; Arauzo-Carod and Viladecans-Marsal, 2009). For over a century, since the seminal study of Marshall (1890/1920) with the definition of spatial agglomeration economies (externalities deriving from the clustering of firms in space), researchers have studied the location behaviour of economic activities and the major reasons explaining geographical patterns of the industrial activity.

The empirical literature on the determinants of industrial location (e.g., agglomeration economies, human capital, taxes, wages) has increased in recent decades (e.g., Arauzo-Carod and Manjón-Antolín, 2004; Arauzo-Carod and Viladecans-Marsal, 2009; Alamá-Sabater et al., 2011; Guimarães et al., 2011; Arauzo-Carod, 2013). Two different approaches have been used in terms of modelling the location choices. One is focused on the choice behaviour of the firm/ agent (e.g., Arauzo-Carod and Manjón-Antolín, 2004; Alamá-Sabater et al., 2011). The other puts emphasis on the perspective of the territory where the firms are to be located (e.g., Arauzo-Carod and Viladecans-Marsal, 2009; Arauzo-Carod, 2013). Discrete Choice Models (DCM) are applied when the focus is on the firm and how the respective features of the firm (firm size, industrial sector, employment) or of the territory (infrastructures, inhabitants) have an impact on location choices. If the perspective is on the region and the determinants affecting location choices are studied in terms of firm entries on the region, then Count Data Models (CDM) are employed (Arauzo-Carod et al., 2010).

These modelling techniques have been mainly used for estimating the location patterns of manufacturing industries (e.g., Arauzo-Carod and Viladecans-Marsal, 2009; Manjón-Antolín and Arauzo-Carod, 2011; Alamá-Sabater et al., 2011; Liviano and Arauzo-Carod, 2012; Arauzo-Carod, 2013).

The study of location patterns of creative industries has mostly been comprised of exploratory analyses using the region as the unit of analysis (e.g., Lazzeretti et al., 2012; Miguel-Molina et al., 2012; Bertacchini and Borrione, 2013; Boix et al., 2013; Lazzeretti, 2013). Although such studies refer to the importance of studying the location determinants of creative activities, the modelling of their location behaviour using

micro-data at a firm level is still in an emerging stage of development (Boix et al., 2013). A micro-data analysis which focuses on firms/ establishments rather than on industries or regions permits capturing external economies in a detail where the effects of agglomeration economies have not yet been fully accounted for (Baldwin et al., 2010).

In this context, two contributions to the empirical literature on creative industries are made in this paper. First, it analyses the location behaviour of creative industries at a firm micro-level using highly detailed data on firms. Second, it assesses the role played by location determinants for the creative industries as a whole and for each creative sector in isolation, accounting for the potential heterogeneity of location behaviour across creative industries, using some of the most recent modelling approaches to location (e.g., Guimarães et al., 2004, 2011; Alamá-Sabater et al., 2011; Arauzo-Carod, 2013).

The next section reviews the determinants of industrial (and creative) activity locations, putting forward the main hypotheses of this study. In Section 3, the methodology is presented, namely the econometric specification of location of creative firms to test for those hypotheses and the description of the data used in the estimations. The estimation results are presented and discussed in Section 4. Section 5 concludes the paper, summarising this study's main contributions and limitations, and makes suggestions for future research.

2. Empirical literature on the determinants of industrial location

Existing empirical research has studied the effects of industrial location factors, such as the role of agglomeration economies (e.g., Arauzo-Carod and Viladecans-Marsal, 2009; Figueiredo et al., 2009; Baldwin et al., 2010), technology/ R&D (Autant-Bernard, 2006; Ellison et al., 2007), taxes/ regional grants (Devereux al., 2007), human capital/ skilled labour (Arauzo-Carod, 2013), etc., on firms' location choices.

Among the empirical studies on the geography of creative industries (e.g., Miguel-Molina et al., 2012; Lazzeretti et al., 2012; Bertacchini and Borrione, 2013; Boix et al., 2013; Lazzeretti, 2013), the most referred determinants of location have been associated with agglomeration economies, including localization/ location economies (firm size, industrial concentration) and urbanization economies (industrial diversity, social capital, market size, population density), as well as with the three *T*'s of Florida (2002), namely

Tolerance/ Openness (cultural amenities, foreign-born population/ rate of acceptance of foreign people/ share of foreign population), *Talent/ Human capital* (share of population with university degree, highly skilled/ qualified jobs), and *Technology* (R&D investments, patents created/ registered, employment density/ location quotient of high-tech manufacturing firms).

Agglomeration Economies

Agglomeration economies, primarily comprised of localization economies - industrial concentration externalities, lower transportation costs, increasing returns to scale, benefits from labour market pooling and the sharing of local knowledge - as earlier described by Marshall (1890/1920), represent crucial factors in industrial location modelling (see Table 4.1).

The geographical clustering of firms/ industries allows for industrial specialization as well as accessibility and sharing of specialized intermediate goods and services, networks of supplier-customer relationships and skilled labour resources, which explains the reduction of transportation/ trade costs and leads to increasing internal economies of scale of clustered firms. In turn, the sharing of knowledge predominantly arises from tacit, local, industry-specific technological sources, disseminated through spatial proximity (Harris, 2011).

Urbanization economies represent another source of agglomeration economies (cf. Table 4.1) in regard to product diversification, industrial diversity, access to skilled labour, to a varied range of suppliers and to large consumer markets. The co-location of diverse and interdependent economic activities/ employment in urban agglomerations promotes inter-sector synergies and leads to better access to public utilities (cultural, institutional, political) and information centres, thereby facilitating the diffusion and the sharing of knowledge and innovation (Jacobs, 1969).

A vast array of literature dedicated to the analysis of different types and effects of agglomeration externalities emerged in the last decade (Harris, 2011). This topic has been widely explored and the studies appear to be primarily related with the effects of traditional factors such as transportation costs, increasing returns to scale, and industrial specialization as determinants of firms' location choices.[27]

[27] Comprehensive reviews of literature have been carried out by Rosenthal and Strange (2004: 2119) on the "nature and sources of agglomeration economies"; by Duranton and Puga (2004: 2063) on "the theoretical micro-foundations of urban agglomeration economies"; by Melo et al. (2009: 332) on a "meta-

Recent empirical research on the location of manufacturing/ industrial establishments generally report significant and positive effects of the different sources of agglomeration economies as determinants of firms' location choices (see Table 4.1). Specifically, localization economies (e.g., industrial concentration, local employment density, industrial employment share, firm size, transportation and trade costs) and urbanization externalities (e.g., population density, industrial mix, industrial employment share/ services share, industrial diversity) stand as relevant location determinants with a statistically significant positive impact on firms' location decisions.

In their location analysis of 17,719 new manufacturing establishments in medium- and low-technology activity sectors (Natural Resources and Manufacturing industry sectors) across Catalan municipalities (1987-1996), Arauzo-Carod and Manjón-Antolín (2004) find that agglomeration economies - employment concentration in each industrial sector and the industrial diversity index - exert positive, significant effects on the entrants' decisions, due to the externalities (e.g., local knowledge, sharing of common resources) arising from industrial concentration and inter-sectorial linkages. Localization and urbanization economies also play an important role in the location decisions of new manufacturing plants (manufacturing industry sectors) in counties of 48 U.S. states (1989-1997), with Guimarães et al. (2004) reporting a statistically significant impact of the number of establishments/km^2 and of the county density of manufacturing/ service establishments/km^2 on firms' location decisions. With a focus on the intra-metropolitan level in 13 big metropolitan areas of Spain, for 5,569 new high, intermediate and low-technology manufacturing establishments (high-tech sectors: high-technology equipment manufacturing; intermediate-tech sectors: machinery/ equipment manufacturing and chemical products; low-tech sectors: food and beverages, textiles and leather), in 1992-1996, the role of agglomeration economies was analyzed by Arauzo-Carod and Viladecans-Marsal (2009), who conclude for the significant, positive impact of localization economies (industrial concentration, measured by the previous entries) on entrants' location choices. Urbanization economies, proxied by population density, show a mixed effect: positive for new entrants of low and high-technology sectors and no impact on intermediate-technology firms. This is due to the particular needs of high and low-technology firms, namely diversity economies/ innovation flows mostly found in populous cities for the high-technology entrants, and labour supply for

analysis of estimates of urban agglomeration economies"; by Puga (2010: 203) on the "magnitude and causes of agglomeration economies".

the low-technology firms. Focusing on all the manufacturing industries, the study of Manjón-Antolín and Arauzo-Carod (2011) on new and relocated industrial establishments in 946 Catalan municipalities (2001-2004), concludes for the positive effects of either localization economies (industry employment share) or urbanization externalities (workers by km^2, industrial diversity) on firms' location decisions. Also analyzing all manufacturing industry sectors, similar results are reported by Alamá-Sabater et al. (2011) on the location of 8,429 manufacturing establishments in the 45 municipalities of Murcia, Spain in 2006. The authors obtained a significant, positive impact of localization (industrial specialization, industry employment share) and urbanization economies (population density, industrial diversification index) on the establishments' location choices. Likewise, Liviano and Arauzo-Carod (2012) obtain positive, significant effects of localization and urbanization economies (employment density, industrial mix) in the location decisions of manufacturing establishments in all Natural-Resource and Manufacturing sectors across 941 Catalonian municipalities (2002-2004). In the same activity sectors, Arauzo-Carod (2013) analyses 4,282 manufacturing firms in all Catalonian municipalities, from 2001 to 2005, and finds that their location choices are positively affected by the agglomeration economies (percentage of manufacturing jobs/ population density).

The positive effects observed are mainly due to the so-called Marshallian externalities from industry agglomeration (e.g., information spillovers/ local networking/ input sharing/ local labour market), and to the diversity economies arising from the proximity to urban/ innovative environments and to a varied range of industries and amenities (industrial mix, labour supply, supplier variety, transportation infrastructures, large consumer markets) (Harris, 2011).

According to the empirical literature on creative industries, localization economies, and particularly urbanization economies, are expected to have an important effect on the location behaviour of creative industries/ firms (Florida, 2002; Lazzeretti et al., 2012). Indeed, innovation and creative processes are deeply intertwined with the urban environment (Florida, 2002, 2005), and creative industries tend to concentrate in cities and metropolitan areas in order to take advantage of the urbanization economies, provided by the development of new ideas, product differentiation and technological diversity, the geographic concentration of people, cultural diversity and the diffusion of new trends (Jacobs, 1969). In this context, we put forward the following hypothesis:

H1. Agglomeration economies - localization and urbanization economies - are positively related to creative firms' location choices.

Table 4. 1: Location determinants and respective effects in empirical literature: agglomeration economies

Location Factors	Statistical Effect	Authors/ Study
Localization Economies	✓ Municipality's employment density: positive effect on the location of new manufacturing plants.	Liviano and Arauzo-Carod (2012)
	✓ Establishment Size: positive effect of small sized-firms on the location of new plants (e.g., networks).	
	✓ Agglomeration economies (Industrial Specialization // Industrial employment Share): significant, positive effects.	Alamá-Sabater et al. (2011)
	✓ Industrial Surface: positive, significant effect.	
	✓ Localization economies (industry employment share): significant, positive effects on the location of start-ups/ new firms.	Manjón-Antolín and Arauzo-Carod (2011)
	✓ Localization economies (previous entries): significant, positive effect for all industries.	Arauzo-Carod and Viladecans-Marsal (2009)
	✓ Localization economies (number of establishments per km2): statistically significant, positive effect.	Guimarães et al. (2004)
	✓ Localization Economies (comarca level): employment/ industrial concentration (number of workers per km^2 in each industrial sector) have positive, significant effects in the location of manufacturing entrants.	Arauzo-Carod and Manjón-Antolín (2004)
Urbanization Economies/ Industrial Diversity	✓ Population density: statistically significant/ positive effect.	Arauzo-Carod (2013)
	✓ Industrial Mix/ Percentage of manufacturing jobs: statistically significant, positive effect.	
	✓ Higher percentage of small firms: statistically significant, negative effect (congestion effects).	
	✗ Concentration Index: not significant.	
	✓ Industrial Mix/ Percentage of manufacturing jobs: statistically significant, positive effect.	Liviano and Arauzo-Carod (2012)
	✓ Population (total by municipality): positive, statistically significant.	Alamá-Sabater et al. (2011)
	✓ Industrial diversity: positive, statistically significant effect.	
	✗ Services employment Share: not statistically significant.	
	✓ Urbanization economies (workers per km^2): statistically robust, positive sign.	Manjón-Antolín and Arauzo-Carod (2011)
	✓ Industrial Diversity: statistically robust; entrants prefer more diversity at the municipality level.	
	✓ Population density (urbanization economies): mixed effect - a positive impact on new entries for firms belonging to low- and high-technology groups// ✗ No impact on intermediate-technology firms.	Arauzo-Carod and Viladecans-Marsal (2009)
	✓ Urbanization economies (county density of manufacturing/ service establishments per km^2): statistically significant, positive effect.	Guimarães et al. (2004)
	✓ Urbanization economies (industrial diversity): significant, positive effect on the location decisions at municipality level.	Arauzo-Carod and Manjón-Antolín (2004)
Transports Infrastructures/ Costs	✓ Transport infrastructures variables - County capital// located near the coast line: positive effect; greater distance from the provincial capital: negative effect.	Arauzo-Carod (2013)
	✓ Altitude: negative effect on industrial location// Areas at sea level: positive sign.	Liviano and Arauzo-Carod (2012)
	✓ Transport time to Cities: Negative (expected) effect.	
	✗ Transport infrastructures: non-significant effects on the frequency of strictly new and relocated plants.	Manjón-Antolín and Arauzo-Carod (2011)
	✓ Distance from each municipality to the central city: statistically significant, negative effects for all high- and intermediate-technology sectors.	Arauzo-Carod and Viladecans-Marsal (2009)

Talent/ Human Capital

Several authors (e.g., Florida, 2002, 2005; Markusen, 2006; Scott, 2006; Florida et al., 2008; Lazzeretti et al., 2012) have documented the role of urban centres in attracting human capital and creative people as factors of regional growth. Although some contend that there is a causal relationship between the concentration of human capital and the location of creative industries (Florida, 2002, Lazzeretti et al., 2012), to the best of our knowledge this causality has not yet been addressed through the empirics of location of firms belonging to creative industries.

In recent literature, studies on the effects of human capital and skilled labour on industrial location choices have mostly been done on firms in the manufacturing industry sectors, using the regional/ territorial dimension of human capital (e.g., Arauzo-Carod and Manjón-Antolín, 2004; Arauzo-Carod and Viladecans-Marsal, 2009; Alamá-Sabater et al., 2011; Manjón-Antolín and Arauzo-Carod, 2011; Liviano and Arauzo-Carod, 2012).

Existing studies allow for a diversified range of effects according to the measure of human capital and the type of firms (e.g., high, medium and low-technology) that are considered in models (see Table 4.2). For instance, in a location study of new manufacturing establishments in the medium and low-technology sectors (natural resources/ manufacturing industry sectors) across Catalan municipalities, Arauzo-Carod and Manjón-Antolín (2004) find a significant negative effect of human capital, measured by the number of people with medium and high levels of education per km^2, on firms' location choices. Using the percentage of population with a university degree as a proxy for higher education human capital, similar findings are obtained by Arauzo-Carod and Viladecans-Marsal (2009) from firms of intermediate and low-technology industry sectors in 13 big metropolitan areas of Spain where a significant negative effect is detected (e.g., 'Machinery and equipment', 'Chemical products' and 'Textiles'). Regarding lower levels of human capital, the authors obtain an overall significant positive effect of intermediate human capital (percentage of the population who completed secondary school) in almost all the activity sectors. Some potential explanations lie in the characteristics of firms under study, belonging to medium and low-technology sectors which do not require a highly skilled workforce, or to local job matching, where the highly skilled human capital may not reside in the same regions where the employing firms are located, but rather in neighbouring areas with a better

quality of life (Arauzo-Carod and Manjón-Antolín, 2004; Arauzo-Carod and Viladecans-Marsal, 2009). In contrast, on the location determinants of industrial establishments in all manufacturing industry sectors, across all the municipalities of Murcia, Spain, a significant positive effect of human capital - measured by the percentage of labour force that has completed secondary and tertiary level education - is described by Alamá-Sabater et al. (2011), who conclude that the role of highly skilled workers on firms' location decisions is important. Also Manjón-Antolín and Arauzo-Carod (2011), on their analysis of new and relocated establishments in all manufacturing industry sectors (from high- to low-technology sectors) in Catalan municipalities, find a significant positive effect of human capital (percentage of population working in science and technology/ percentage of graduates with a university degree in population over 25-years old) on start-ups' location choices. In turn, Liviano and Arauzo-Carod (2012), using a database comprising medium-to-low technology firms of the natural-resource and manufacturing industry sectors across Catalonian municipalities, find a negative effect of human capital (measured by the average years of schooling of the population over twenty-five years of age) on firms' decisions, which arguably might be explained by lower requirements for highly-skilled human capital, as in Arauzo-Carod and Manjón-Antolín (2004) and Arauzo-Carod and Viladecans-Marsal (2009).

Addressing the issue of sector/ industry characteristics more explicitly, suggested to some extent in Arauzo-Carod and Viladecans-Marsal (2009), in his location study of manufacturing firms in Catalonian municipalities, Arauzo-Carod (2013) demonstrates that the requirements of human capital are industry-specific, and only in the case of high-tech firms, the human capital in the region - measured by the number of individuals with higher education relative to the number of jobs - has a significant positive effect on firms' location choices.

Also, the residence region of the highly-skilled workers/ human capital may not coincide with the place where the firms are located. This mismatch is explained by the preference of the workforce to live neighbouring regions, which leads to spatial lags of human capital (Alamá-Sabater et al., 2011; Arauzo-Carod, 2013).

Table 4. 2: Location determinants and respective effects in empirical literature: human capital

Human capital	Statistical Effect	Authors/ Study
Territorial perspective	✖ Average years of schooling of the population over twenty-five years of age: negative effect on the entry of new firms.	Liviano and Arauzo-Carod (2012)
	✔ Percentage of labor force with secondary and tertiary education by municipality: positive, statistically significant, most important effect.	Alamá-Sabater et al. (2011)
	✔ Percentage of population working in science and technology// % of population with a university degree// average years of education of population over 25 years old: statistically significant, positive effects on the location of start-ups.	Manjón-Antolín and Arauzo-Carod (2011)
	✖ Human Capital (number of people with medium and high levels of education per km^2): negative coefficient.	Arauzo-Carod and Manjón-Antolín (2004)
Industry/ sectorial perspective	✖ Human-capital variables (Nº individuals in each degree of educational attainment relative to nº jobs (illiterate // incomplete primary// primary education// middle school// technical high school// high school// intermediate university degree// advanced university degree): non-significant effects. ✔ Human-capital/ Highly skilled labour: Only for high-tech firms, there is a positive effect (human capital is an industry-specific factor). ✔ Spatially lagged human-capital variables: some significant and positive effects.	Arauzo-Carod (2013)
	✔ Human-capital Intermediate level (percentage of the population with complete secondary school): significant, positive effect on firms in all industries. ✖ Human-capital University level (percentage of the population with a university degree): significant negative impact for firms in intermediate and low-technology industries.	Arauzo-Carod and Viladecans-Marsal (2009)

Thus, empirical studies show negative, positive, mixed or non-significant effects of human capital on firms' location decisions, largely depending on the database or on the measure of human capital that is used. It is also suggested that, besides considering the role of human capital as an attribute of regions, it is important to take into account the industry-specific and firm-level characteristics - in terms of knowledge-base, employees' skills and educational level of the labour force - when analysing the impact of human capital on firms' location choices.

Given these considerations, we present a second hypothesis as follows:

H2a. The region's human capital is positively related to creative firms' location choices.

H2b. Human capital existent in each creative firm is related to its location choices.

Tolerance

Tolerance can be also considered as a key location determinant, since higher receptivity to newcomers, new influences and lifestyles are likely to attract creative firms to a

particular region (Florida, 2002, 2005; Florida et al., 2008). Although this factor is not usually considered in location models, recent research on the geography of creative industries acknowledges the importance of institutional and tolerance-related variables on the analysis of these firms' location behaviour (e.g., Hansen, 2007; Florida et al., 2008; Lazzeretti et al., 2012; Mellander et al., 2013). Specifically, it is found that large urban centres are more likely to have a tolerant atmosphere, characterized by their openness to racial and sexual minorities as well as to other nationality groups/ foreigner people/ immigrants. This openness promotes a diversified local social network, where trust and social capital increase the effectiveness of relationships (Florida, 2002, 2005). On a study on location determinants for the creative class and regional development across all U.S. metropolitan areas, Florida et al. (2008) proved that tolerance (proxied by gay and bohemian indexes) allows for a higher accumulation of human capital and creative workers, complementary skills embodied in the immigrants, and artistic networks as channels of information among firms/ industries in the region. Thus, the more tolerant a region is the more favourable it will be to an open business climate characterized by urbanization economies, positively affecting the location decisions of creative firms and creative workers (Jacobs, 1969; Florida et al., 2008).

Given these arguments, the third hypothesis is established as:

H3. The region's tolerance is positively related to creative firms' location choices.

Technology

Technological endowments (facilities, provisions, firms, products, networks) represent an important factor of firms' location patterns, particularly for knowledge-intensive and creative firms (Florida, 2002, 2005), given the role of localized, shared knowledge in the development of innovative and creative activities. As innovations and the outcomes of technological/ R&D facilities tend to spread locally, mainly due to aspects such as trust and reciprocity characterizing the networks where local knowledge is transferred (Feldman, 2000), technology provisions are a critical asset in promoting an environment where externalities arise in the form of tacit knowledge and encourage the creation of further knowledge/ innovative activities (Audretsch et al., 2007).

There is a wide corpus of empirical literature corroborating the relation between technology, knowledge and the spatial clustering of firms and industries (e.g., Jaffe et al., 1993; Audretsch and Feldman, 1996; Tödtling et al., 2004; Autant-Bernard, 2006;

Audretsch et al., 2007). The mechanisms behind the relationship between technological endowments and the geographical clustering of firms are related to the ways through which local knowledge is diffused (Tödtling et al., 2004). Knowledge spillovers arise from labour mobility, local buzz, social networks, regular firms' inter-relations, face-to-face contacts, spinoffs or innovation joint projects, among others (Feldman, 2000; Audretsch et al., 2007). These spillovers explain the findings of Jaffe et al. (1993) on their study on the geographic location of patent citations and their spatial flows across the metropolitan areas of U.S. states, where the authors conclude that knowledge created at a regional level tends to be highly localized and stimulates the accumulation of additional knowledge in the same territorial unit. Likewise, on the geography of innovative activities across all U.S. states, Audretsch and Feldman (1996) discover that industries where knowledge spillovers (through industry innovations/ university research/ skilled labour) are more important show a higher tendency for the spatial clustering of innovative activities than other industries for which knowledge externalities are less significant. Allowing a deeper understanding of the mechanisms through which local knowledge is transferred, Tödtling et al. (2004) undertake a firm survey in Austria, comprising the manufacturing medium-tech sectors, high-tech industries, knowledge and innovation-based services and research firms, among others. The authors conclude that in the case of manufacturing and knowledge and innovation-based services, knowledge is mainly transferred through supplier-buyer relationships/ markets, informal interactions and expert/ labour mobility. In high-tech firms, there is a particular relevance for research projects, formal networks, R&D joint collaboration and consultancy as mechanisms of knowledge exchange. Research firms make more use of explicit/codified knowledge such as scientific patents, formal contracts and research collaboration. Also proving the spatial clustering of knowledge activities is the study of Autant-Bernard (2006) on the location determinants of research and development firms/ labs across all regions of France, where the stock of knowledge available in the region (proxied by private R&D expenditures of the other labs located in the region), as well as the presence of knowledge spillovers (spatial lag of those expenditures) have significant positive effects on research labs' location decisions. These findings are also described in the study of Audretsch et al. (2007) on the location determinants of 75 German planning regions, where it is concluded that R&D facilities/ headquarters tend to concentrate in urban centres characterized by knowledge diversity, creativity and a business climate receptive to the creative innovation.

As shown in the empirical studies, the presence of a network of interdependent high-tech/ knowledge-based firms promotes the development of local innovation processes and encourages the transmission of knowledge, new ideas and patents (Tödtling et al., 2004). This ultimately leads to growth of the region, which attracts even more knowledge-based and creative capital, given that the industries that most rely upon this asset tend to locate where their potential might be reinforced (Florida, 2002, 2005; Audretsch et al., 2007).

Besides the role played as a territorial determinant (reflected, for instance, by a region's research and development investments/ number of patents created/ density of high-tech firms), technology can be also considered as an industry-specific factor (high, medium and low-technology industries), which affects creative firms' location choices. In this line of reasoning, the fourth hypothesis is set as follows:

H4a. The region's technological endowments are positively related to creative firms' location choices.

H4b. Industry technological intensity is related to creative firms' location choices.

Inter-territorial spillovers

The benefits for firms locating in a particular region may be affected by the characteristics of surrounding locations. Inter-territorial spillovers are the effects that territory-specific (economic, social, cultural, geographic) attributes of neighbouring regions may have on a particular location. They have been recently studied and appear to be relevant in industrial location choices (e.g., Autant-Bernard, 2006; Arauzo-Carod, 2007; Alamá-Sabater et al., 2011; Guimarães et al., 2011). Indeed, there are flows characterized by supplier-buyer linkages, company interactions, industry interdependencies, labour/ human capital mobility, intellectual/ knowledge spillovers, which not only explain the (co)agglomeration patterns within each region, but also occur beyond the established frontiers of each territorial unit, with an influential effect on firms' location choices (Autant-Bernard, 2006; Ellison et al., 2007; Alamá-Sabater et al., 2011). For instance, firms may get benefits from locating near regions (e.g., large urban centres) with large consumer markets, intensive production linkages, high population density, human capital, supplier and distribution chains, but may choose to avoid those territorial areas because of congestion effects. In these cases, the attributes

of nearby regions have a significant positive effect in firms' location choices (Arauzo-Carod, 2007).

Despite the importance of neighbouring effects, to the best of our knowledge this issue has not yet been specifically addressed in the empirical literature on the location of creative industries.

Inter-territorial spillovers are reflected in spatial autocorrelation, which occurs when the observations of a variable at a particular region are partially correlated with the variables of neighbouring locations (Arauzo-Carod, 2007). From this perspective, location choices are not only affected by the attributes of the chosen territory but may also depend on the characteristics of nearby areas. This is analysed by Autant-Bernard (2006), on the study of regional determinants of R&D labs/ firms across the French NUTS 2 regions, where it is proved that spatial knowledge spillovers, proxied by the spatially-lagged term of private R&D expenditures, exert a significant positive effect in R&D labs/ firms' location decisions. The author concludes that the selection of a particular region is not only influenced by the relative stock of knowledge present in the region but also by that of nearby regions.

The significance of inter-territorial spillovers is also observed in Alamá-Sabater et al. (2011) on the location factors of 8,429 industrial establishments in the 45 municipalities of Murcia, Spain. Their findings show that spatial spillovers have a significant impact on firms' location decisions, with a declining effect as municipalities become more distant. In fact, the authors find that the attributes of neighbouring regions have a similar impact as those of the chosen municipality in firms' location decisions. This is due to the presence of spatial dependence effects, which become more important when the analysis is undertaken at a more disaggregated level (e.g., municipalities, local metropolitan areas) and there is a sharing of economic, socio-cultural, infrastructural/ connectivity and other territorial aspects among neighbouring regions (Arauzo-Carod, 2007; Alamá-Sabater et al., 2011).

Applying to employment data by industry/ establishment of manufacturing industry sectors across U.S. states/ counties, Guimarães et al. (2011) incorporate spatial neighbouring effects in measures of industrial concentration,[28] and conclude in support

[28] The authors develop a spatially weighted Ellison-Glaeser index accounting for the spatial neighbouring effects, which offers more detailed information in measuring spatial economic concentration than popular measures of localization such as Gini, Herfindhal and common Ellison-Glaeser indexes that only consider

of the improvements obtained in the spatially-weighted index when compared to the original corresponding measure.

In this line of argumentation, we hypothesise that:

H5. Inter-territorial spillovers of neighbouring regions explain creative firms' location choices.

3. Methodology

3.1. Data considerations

The data comprises all (369) creative start-ups or new establishments created in 2009,[29] in all the creative industries, distributed across all 308 Portuguese municipalities. The source of the data is the Linked Employer-Employee Databases of GEE/ ME, Portugal. It covers all employment in industries and establishments operating in the national territory with at least one employee, excluding Public Administration and self-employment.[30] According to the latest data available (2009), national employment in the private, structured sector totalled 3,128,126 workers, operating in a total of 407,235 establishments in all the activity sectors.

Although in 2009 a total of 12,246 creative establishments ran businesses in Portugal, we had to restrict our analysis to the newly created establishments in order to avoid any endogeneity effects between firms' location choices and the determinants of such choices.

Nine major creative industries were considered for the analysis - Advertising and Marketing; Architecture; Design; Film, Video and Photography; TV and Radio; Music/ Entertainment and the Performing Arts; Publishing; Software and Digital Media; and Research (cf. Table 4.3).

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the information inside each pre-defined territorial unit. Besides all the information within the limits of each geographical unit, these authors' index includes the spillovers that lie outside the boundaries of each territory.

[29] This is the latest data available at the time of this study (June 2014). Courtesy of GEE/ ME, Gabinete de Estratégia e Estudos, Ministry of Economy, Portugal (*Quadros de Pessoal*, Linked Employer-Employee Databases).

[30] Further implications on the aspects of this database are discussed in Cruz and Teixeira (2013).

Table 4. 3: Creative industry sectors - mapping the creative startups/ new establishments (n=369)

Core Creative sectors	Industries	Portuguese CAE - Rev. 3 Industry codes (compatible with ISIC - Rev. 4 codes)
1. Advertising and Marketing	Advertising; Market research/ public opinion polling	**7311; 7312; 7320**
2. Architecture	Architectural activities	**7111**
3. Design	Design activities	**7410**
4. Film, Video and Photography	Motion picture, video and television production, post-production, distribution and projection activities; Photographic activities	**5911; 5912; 5913; 5914; 7420**
5. TV and Radio	Radio activities; Television activities	**6010; 6020**
6. Music/ Entertainment and the Performing Arts	Sound recording/music publishing activities; Performing arts; Support activities to performing arts; Artistic and literary creation; Operation of arts facilities; Amusement/ recreation activities	**5920; 9001; 9002; 9003; 9004; 9321; 9329**
7. Publishing	Publishing of books, periodicals/ others; Translation/interpretation activities; Libraries/archives/ museum activities; Information service activities (news agencies)	**5811; 5812; 5813; 5814; 5819; 7430; 9101; 9102; 9103; 9104; 6391; 6399**
8. Software and Digital Media	Software publishing; Computer programming/ consultancy; Data processing/hosting/Web portals	**5821; 5829; 6201; 6202; 6203; 6209; 6311; 6312**
9. Research	Research on natural sciences, engineering, social sciences and humanities	**7211; 7219; 7220**

Note: For a detailed account of the relevant creative industries see Cruz and Teixeira (2014).

Given that our purpose includes the testing for neighbourhood effects on creative firms' location behaviour, through the use of spatially-lagged explanatory variables, in order to account for the spatial dependence among regions, the most suitable territorial unit of analysis is the municipality - as is shown in most recent empirical literature (e.g., Alamá-Sabater et al., 2011; Liviano and Arauzo-Carod, 2012; Arauzo-Carod, 2013).

3.2. Location determinants: variables selected and respective indicators

In order to account for the location economies and to capture the benefits from the co-location of creative firms with interdependent activities/ knowledge-based firms, we used a standard measure, which is usually applied in the empirical literature for its analytical tractability (e.g., Alamá-Sabater et al., 2011; Miguel-Molina et al., 2012; Lazzeretti et al., 2012) - the location quotient (LQ)[31] (see Table 4.4). Based on the employment by industry sector in each region, we calculated the LQ in all the

[31] The LQ captures the degree of specialization in a given industry, for each region, in comparison with the national average in that industry.

municipalities for: i) creative firms (*LQ Creative firms*), service-based firms (*LQ Service firms*); iii) knowledge-based activities (*LQ Knowledge firms*).

Regarding urbanization economies, we used a traditional proxy describing the effects of urban agglomeration, *Population Density* (e.g., Arauzo-Carod and Viladecans-Marsal, 2009; Arauzo-Carod, 2013), which is robust to differences in land surface sizes and allows control for urban scale economies deriving from populated regions (Melo et al., 2009). To account for the industrial mix and the external economies transversal to all firms/ industries, we computed indexes based on the Herfindahl-Hirschman Index, usually adopted by the extant empirical research on industrial location (e.g., Arauzo-Carod and Manjón-Antolín, 2004; Alamá-Sabater et al., 2011; Manjón-Antolín and Arauzo-Carod, 2011; Liviano and Arauzo-Carod, 2012): Index of industrial diversity (*Industrial Diversity*) and Index of creative industries' diversity (*Creative Diversity*), for all 308 municipalities (cf. Table 4.4).

Then, the variables *LQ Creative firms*, *LQ Service firms*, *LQ Knowledge firms*, *Population Density*, *Industrial Diversity* and *Creative Diversity* were included in our model to test *Hypothesis 1* ("*Agglomeration economies are positively related to creative firms' location choices*").

To examine the implications of *Hypothesis 2a.* ("*The region's human capital is positively related to creative firms' location choices*"), human capital variables at the municipality level - graduates of higher education human capital, measured by the percentage of population with a completed degree (*Higher Education*) and intermediate human capital, proxied by the gross enrolment rate in upper secondary education (*Secondary Education*) - were incorporated in the model. Since human capital is also a firm-level asset, we also considered the average educational attainment of the workers in each of the firms in our database, to test for the *Hypothesis 2b.* ("*Human capital existent in each creative firm is related to its location choices.*").

Following Florida (2002, 2005) and Lazzeretti et al. (2012), tolerance-related indicators include local cultural amenities (*Culture*) proxied by the number of museums and recreational facilities by municipality, immigrant legalization rate (*Foreigners*), and a social inequality ratio (*Social Inequality*) (cf. Table 4.4), with the aim of checking the *Hypothesis 3* ("*The region's tolerance positively affects creative firms' location choices*").

To test *Hypothesis 4a.* ("*The region's technological endowments are positively related to creative firms' location choices*"), technology endowments at a regional level are proxied by the proportion of business research and development expenditures in regional gross domestic product (*R&D Firms*), in line with Autant-Bernard (2006). In each region, technology is usually proxied in terms of R&D expenditures (in total turnover), R&D workers (in total workers), or patents owned (e.g., Jaffe et al., 1993; Audretsch et al., 2007). We opted for not including patents ('codified' knowledge), as R&D private investments more properly capture all the localized knowledge, 'tacit' and 'codified' (Autant-Bernard, 2006), that is likely to be incorporated in the innovation process of creative firms (Florida et al., 2008).

At the industry level, and in order to test for the *Hypothesis 4b.* ("*Industry technological intensity is related to creative firms' location choices*"), we categorize the industries/ firms in terms of their technology intensity: very high, high, medium-high and medium-technology.

The neighbouring effects in firms' location decisions are analyzed by introducing spatially-lagged explanatory variables in the model, calculated on the basis of spatial-weights matrices (e.g., Alamá-Sabater et al., 2011). We carry out this analysis by constructing a spatially-lagged model, composed of the explanatory variables and their respective spatial lags, for the purpose of testing *Hypothesis 5* ("*Inter-territorial spillovers of nearby regions explain creative firms' location choices*").

All the variables selected and respective indicators are presented in Table 4.4.

Given that the firm micro-data available comprises all the new creative establishments of the year 2009, each indicator computed for the analysis of regional location determinants refers to 2008 and 2009 or earlier periods, to best describe the existing conditions at the time that those establishments were created.

Table 4. 4: Location determinants: variables and respective indicators/proxies

Location determinants	Variable	Proxy	Indicator computation	Source	Reference period
Localization economies (and co-location benefits)	*LQ Creative firms*	Location Quotient of Creative firms	Authors' own computations[1] for all the municipalities (n=308) based on the employment by industry sector: $\frac{E_j^s / \sum_{s'=1}^{S} E_j^{s'}}{\sum_{j'=1}^{J} E_{j'}^s / \sum_{s'=1}^{S} \sum_{j'=1}^{J} E_{j'}^{s'}}$, where E_j^s is sector *s* employment in the municipality *j*.	GEE/ ME, Portugal.	2009
	LQ Service firms	Location Quotient of Service-based firms			
	LQ Knowledge firms	Location Quotient of Knowledge-based activities			
Urbanization economies	*Population Density*	Population Density	Total number of persons/ Area (square kilometer), by each municipality.	INE, Statistics Portugal.	2008
	Industrial Diversity	Industrial Diversity Index	Authors' own computations[2] on the diversity index of all the industry sectors in each municipality (employment data by industry sector): $1 - \sum_r (E_j^r / \sum_{r'} E_j^{r'})^2$ where E_j^r describes industrial employment in sector *r* and municipality *j*.	GEE/ ME, Portugal.	2009
	Creative Diversity	Creative Industries' Diversity Index	Authors' own computations[3] on the diversity index of all creative sectors in each municipality (employment data by creative industry sector): $1 - \sum_t (E_j^t / \sum_{t'} E_j^{t'})^2$ where E_j^t describes industrial employment in creative sector *t* and municipality *j*.	GEE/ ME, Portugal.	2009
Human capital	Region's human capital *Higher Education*	Proportion of resident population with higher education completed (%)	Proportion of the resident population with 21 and more years old with higher education completed in total resident population with 21 and more years old (percentage) by each municipality.	INE, Statistics Portugal.	Census 2001
	Secondary Education	Gross enrolment rate in upper secondary education (%)	Proportion of pupils enrolled on upper secondary education in resident population aged between 15 and 17 years old (percentage) by municipality.	INE, Statistics Portugal.	2008/ 2009
	Firm's human capital	Firms' classification according to high, intermediate and basic educational attainments (based in the average education of all the workers in each establishment); Authors' own computations.		GEE/ ME, Portugal.	2009
Tolerance	*Culture*	Cultural amenities and museums (No.)	Number of museums, zoological, botanic gardens and aquariums by municipality.	INE, Statistics Portugal.	2009
	Foreigners	Foreign population (total number) who have applied for resident status per 100 inhabitants (%)	Proportion of foreign population who have applied for resident status in total resident population (percentage) by municipality.	INE, Statistics Portugal.	2007
	Social Inequality	Social inequality ratio	INE's calculation based on the weight of each socioeconomic group in the municipality's population, by municipality. The ratio varies between 0 (minimum inequality) and 1 (maximum inequality).	INE, Statistics Portugal.	Census 2001
Technology	Region's technological endowments *R&D Firms*	Region's Private R&D investment	Proportion of total expenditures in R&D of Private firms in regional gross domestic product at market prices (percentage) by region.	INE, Statistics Portugal.	2008
	Industry's technological level	Industry's technology intensity	Industry taxonomy by technology intensity (very high, high, medium-high, medium).[4]		2009
Inter-territorial Spillovers			Spatial lags (*_spl*) of the explanatory variables considered above.		2009

Notes: [1] Based on the Linked Employer-Employee Databases of GEE/ ME, Portuguese Government; year 2009. The industry codes have been classified into Services, Knowledge and Creative segments, after their thorough interpretation using the Portuguese CAE - Rev.3 industrial classification (INE, 2007), compatible with ISIC - Rev. 4: *Services* activity sectors (CAE - Rev. 3): 41, 42, 43, 45, 46, 47, 49, 50, 51, 52, 53, 55, 56, 61, 64, 65, 66, 68, 69, 70, 7112, 7120, 7490, 75, 77, 78, 79, 80, 81, 82, 84, 86, 87, 88, 92, 931, 94, 95, 96, 97, 98, 99; *Knowledge* activity sectors (CAE - Rev. 3): 85; *Creative* activity sectors (CAE - Rev. 3): 58, 59, 60, 62, 63, 7111, 72, 73, 7410, 7420, 7430, 90, 91, 932.

[2] Based on the Linked Employer-Employee Databases of GEE/ ME, Portuguese Government; year 2009. The Industry Diversity index was calculated for each municipality according to the formula presented in Alamá-Sabater et al. (2011), taking into account all the activity sectors of the economy.

[3] Based on the Linked Employer-Employee Databases of GEE/ ME, Portuguese Government; year 2009. The Creative Industries' Diversity index was calculated for each municipality according to the formula presented in Alamá-Sabater et al. (2011), considering all the Creative activity sectors as described in Table 4.3.

[4] Authors' own computations based on the taxonomy of Silva and Teixeira (2011).

3.3. A description of the selected modelling approach: Discrete Choice Model

Discrete choice models in industrial location literature (McFadden, 1974) put an emphasis on each firm's selection process behaviour and permit the study of the effects of territorial features (e.g., population density, infrastructures, industrial mix) and firms' attributes (e.g., educational levels, size, activity sector) on location choices, within a set of territorial alternatives (Arauzo-Carod et al., 2010).

On studying the location behaviour of creative industries at the micro-level, our primary interest lies in understanding the effect of territorial and industry-specific determinants on those firms' location choices. For this we use the Discrete Choice Model (DCM) approach, which follows the theoretical setting based on the random utility maximization (RUM) framework (McFaden, 1974), described in the Appendix.

In this context, our model specification for the expected, non-observable, profit (π_{ij}) that each new creative establishment *i* obtains from locating in municipality *j* is given by:

$$\pi_{ij} = \beta_1 Population\ Density + \beta_2 LQ\ Creative\ Firms + \beta_3 LQ\ Service\ Firms + \beta_4 LQ\ Knowledge\ Firms + \beta_5 Industrial\ Diversity + \beta_6 Creative\ Diversity + \beta_7 Higher\ Education + \beta_8 Secondary\ Education + \beta_9 Culture + \beta_{10} Foreigners + \beta_{11} Social\ Inequality + \beta_{12} R\&D\ Firms \quad (4.1)$$

where the right hand side variables in (4.1) are measured by the indicators presented in Table 4.4.

To account for the spatial spillovers among neighbouring municipalities, we additionally introduce the spatial lags (*_spl*) of the explanatory variables. This results in the spatial discrete choice model, described as follows (4.2):

$$\pi_{ij} = \beta_1 Population\ Density + \beta_2 LQ\ Creative\ Firms + \beta_3 LQ\ Service\ Firms + \beta_4 LQ\ Knowledge\ Firms + \beta_5 Industrial\ Diversity + \beta_6 Creative\ Diversity + \beta_7 Higher\ Education + \beta_8 Secondary\ Education + \beta_9 Culture + \beta_{10} Foreigners + \beta_{11} Social\ Inequality + \beta_{12} R\&D\ Firms + \beta_{13} Population\ Density\_spl + \beta_{14} LQ\ Creative\ firms\_spl + \beta_{15} LQ\ Service\ firms\_spl + \beta_{16} LQ\ Knowledge\ firms\_spl + \beta_{17} Industrial\ Diversity\_spl + \beta_{18} Creative\ Diversity\_spl + \beta_{19} Higher\ Education\_spl + \beta_{20} Secondary\ Education\_spl + \beta_{21} Culture\_spl + \beta_{22} Foreigners\_spl + \beta_{23} Social\ Inequality\_spl + \beta_{24} R\&D\ Firms\_spl$$

The spatially lagged explanatory variables are obtained by the matrix product between a contiguity (row-standardized) spatial-weights matrix **W** with the vector **X** of explanatory variables, with the general specification: **X_spl = WX**.

W can be obtained using different approaches (distance-based/ inverse-distance-based, using Euclidean/ Haversine distance-based methods; *k*-nearest neighbours; contiguous neighbours) (see Drukker et al., 2013). In our case, a queen contiguity spatial-weighting matrix with row normalization was the preferred arrangement.[32] Contiguity matrices are commonly used for their suitability to describe what is considered as neighbour in a straightforward sense, only taking into account the spatial dependence among contiguous regions (Drukker et al., 2013). Neighbouring units are assigned weights of 1, and non-contiguous units are assigned weights of 0.[33] Since our purpose is to parameterize spatial spillover effects among nearby/ adjacent municipalities, we found the contiguity matrix the most appropriate one.

3.4. A description of the selected econometric estimation: Conditional Logit Model

In the estimation of the coefficients and other relevant parameters in our model, we use the Conditional Logit Model (CLM), which has been the most commonly used econometric setting in order to empirically estimate the parameters of discrete choice models. The CLM used is composed of variables that vary over alternatives (the generic specification is provided in the Appendix). It allows differentiating among the attributes of choices - *alternative-specific attributes* - and it also estimates taking into account the characteristics of the decision-makers/ firms - *case-specific attributes*.

Despite the computational burden when the set of choices is large (in our case, j=308), major advantages of the CLM are that the parameters, coefficients and marginal effects are easily calculated and interpreted.[34]

The coefficients and relevant parameters in our conditional logit model are estimated by maximizing the log-likelihood function:

[32] Queen contiguity assumes that any geo-referenced polygon (in our case, municipality) that shares even a point-length border, a corner or one vertex with the reference polygon is considered as adjacent, contiguous or a neighbour of the reference polygon.

[33] Using row-sum normalization (each row will have a sum equal to 1), each weight in the matrix will be given by: $w_{ij} = w_{ij}^* / \sum_{j=1}^{n} w_{ij}^*$.

[34] The main limitation of this method lies in the assumption of Independence of Irrelevant Alternatives (IIA). The strictness of the "independence of irrelevant alternatives" axiom is related with the fact that given two alternative choices, X and Y, if X is preferred to Y from the choice set {X,Y}, then inserting a third spatial alternative Z and extending the set to {X,Y,Z} must not make Y preferable to X. That is, preferences for X or Y are not altered by the insertion of the option Z. Guimarães et al. (2004) provide potential ways of dealing with the IIA violation by making use of the relation between CLM and Poisson regression models. Also the use of nested logit models relaxes the IIA assumption by allowing the unobserved factors, ε_{ij}, to be correlated.

$$log\ L_{Conditional\ Logit} = \sum_{i=1}^{N} \sum_{j=1}^{J} y_{ij}\ log\ P_j \tag{4.3}$$

where y_{ij} = 1 if individual *i* chooses alternative *j* and equals 0 otherwise. This leads to the following expression:[35]

$$log\ L_{CL} = \sum_{j=1}^{J} n_j\ log\ P_j \tag{4.4}$$

In order to test all the hypotheses mentioned in Section 2 on the analysis of the location determinants of creative firms, our primary interest is to observe the sign and effect of each explanatory variable (municipality characteristics) on creative establishments' location behaviour.[36]

The CLM estimates yield coefficients that cannot be directly interpreted because firms' profits are not observable and the location choice behaviour can only be analyzed in terms of probabilities. It is only possible to observe the characteristics of alternatives, of firms, and the outcomes of location choices, represented by a binary dependent variable *c*, which equals to 1 if firm *i* decides to locate in a particular region *j*, and 0 otherwise.

The estimation by maximizing the log-likelihood function of the probabilities for all the alternatives (*j*=308), and all the firms (*n*=369), expressed in (4.3) and (4.4) gives us a list of coefficients, specific to each explanatory independent variable (location determinant) in the model. Those coefficients establish the relation between the regressors in model (4.1) and the binary dependent variable of choice *c*.

Given the characteristics of the CLM we are using (see (A4.5)-(A4.7), in Appendix), the estimated coefficients of the alternative-specific regressors can be given an odds interpretation,[37] through the exponentiation of their values (Scott Long and Freese, 2006). Each exponential beta coefficient, *exp(β)*, obtained in the CLM estimates can be translated into the effect/ impact in the odds between locating in a target region versus

[35] P_j is specified in the Appendix by (A4.4).
[36] Obtaining the marginal effects/ elasticities would allow verifying how, ceteris paribus, variations in the explanatory variables influenced the probability of selecting a specific location. Besides the computational burden, given the 308 alternatives/ regions available, the study of marginal effects is not of major relevance at this stage since our focus is on the overall effects/ sign of each location determinant on creative firms as a whole, and according to the attributes of creative firms in our database.
[37] Coefficients of the alternative-specific regressors directly obtained in CLM estimations are commonly identified as *log-odds ratios*.

locating in one of the other alternative locations, of a unit variation in the corresponding explanatory variable (location's attribute).[38]

Intuitively, a positive CLM coefficient (or *log-odds ratio*) means that if the explanatory variable has an increase of one unit, then the target alternative is more likely to be chosen and the other alternatives are less likely to be chosen, *i. e.*, increases the odds of choosing the target alternative; the opposite rationale for a negative coefficient. Thus *exp(β)* reflects the impact of a unit change in the alternative-specific regressor, in the odds of choosing a particular alternative versus one from all the other alternatives (Scott Long and Freese, 2006).

4. Empirical results

4.1. Results for creative firms as a whole

An exploratory analysis of our database of new creative establishments (n=369) infers that creative firms tend to cluster around a small number of large/ important urban centres (cf. Figure 4.1). Mainly, they locate in the most relevant North-Centre cities (Porto, Aveiro, Coimbra and Leiria), as well as in Lisbon and Oeiras (the capital city and a densely populated high-tech municipality near Lisbon, respectively).

Also, a heterogeneity of location patterns according to the creative industry sector has been previously detected: 'Advertising/ Marketing', 'Publishing' and 'Software/ Digital Media' mostly concentrated in large urban centres; 'Architecture' and 'Design/ Visual Arts' distributed around intermediate urban centres in the North-Centre of the country; 'Research' quite dispersed throughout the territory with concentration around municipalities with higher-education institutions; 'Film/ Video/ Photography' dispersed throughout the territory with some clusterization around large urban centres; and 'Music/ Entertainment/ Performing arts' distributed across tourism/ coastal municipalities (Cruz and Teixeira, 2014).

[38] Expressions (A4.5) to (A4.7) in Appendix allow explaining this effect in the *odds ratio* of a unit change in the explanatory variable.

Figure 4. 1: **Number of new creative establishments in Portugal by municipality (our database; *n*=369 establishments/ *j*=308 municipalities), in 2009**

Source: Authors' computations based on STATA 13 ® and micro-data from the Linked Employer-Employee Databases, GEE/ ME, Portugal (year 2009).

Given this evidence, we seek to uncover the main location factors behind the irregular patterns found in creative firms' geographic distribution. In order to assess such determinants, we first estimated a standard Conditional Logit model (standard CLM) and then we added the spatial lags of each explanatory variable in the model (CLM with spatially-lagged variables).[39]

The parameter estimates of the standard CLM are presented in Table 4.5. Goodness-of-fit measures for the model specification (e.g., Wald qui-square test; Likelihood-ratio test; Wald test for the joint significance of variables in the model) infer that the

[39] Estimates were carried out using STATA 13 ® (alternative-specific conditional logit estimation and post-estimation tool packages). The sector of 'TV and Radio' registered no observations in our data.

unrestricted CLM, with all the explanatory variables, is suitably specified when compared to the alternative restricted model. All coefficients are statistically significant (at one, five and ten percent levels), most of them highly significant (at one percent level).

From Table 4.5, and similar to the results obtained by the bulk of research on the location of manufacturing industries (cf. Section 2), it is noticeable that (co)location economies play an important role in creative firms' location decisions. The concentration of creative firms (*LQ Creative Firms*) and the clustering of knowledge-based activities (*LQ Knowledge Firms*) are statistically significant and exert a positive effect on the decisions of creative establishments. There is enough evidence to maintain that creative firms tend to locate where other creative and knowledge-based activities are clustered, suggesting co-location among these sectors/ activities, due to potential interdependencies and local synergies.

In contrast, the concentration of service-business activities (*LQ Service Firms*) has a negative impact on choices. This is a similar result to that obtained in Alamá-Sabater et al. (2011) and may derive from the fact that in large urban centres, service-based activities are not so highly concentrated, or that creative firms privilege interdependencies with other activity sectors such as innovation/ knowledge-based activities. It is mostly in inland/ remote municipalities that services (e.g., health, accountancy or legal activities) usually have more relative importance at a local level.

Regarding urbanization economies, population density (*Population Density*), denoting externalities from urban agglomeration, has a significant, positive effect in firms' location decisions, suggesting the tendency of creative establishments to locate near large consumer markets. In terms of regional industrial mix, estimated coefficients for the diversity indexes of all the activity sectors (*Industrial Diversity*) and of creative industry sectors (*Creative Diversity*) have positive, significant impacts in location choices. This evidence suggests that creative firms tend to favour a diversified industrial matrix both in terms of all the industrial sectors and of the mix of creative industries, substantiating the argument in Lazzeretti et al. (2012) that creative firms privilege local related variety in order to benefit from inter-sectorial, transversal synergies.

Table 4. 5: Standard CLM estimates (*n*=369 cases/ creative establishments; *j*=308 alternatives/ municipalities)

Hypotheses	Variable/ Location Determinant	Estimated Coefficient	Standard Error
H1. Agglomeration (location and urbanization) economies	Population Density	**0.0001***	0.0000541
	LQ Creative Firms	**1.053*****	0.3500657
	LQ Service Firms	**-0.769****	0.3957541
	LQ Knowledge Firms	**0.775*****	0.280637
	Industrial Diversity	**0.141*****	0.0377678
	Creative Diversity	**11.726*****	2.530715
H2. Human Capital	Higher Education	**0.206*****	0.0245704
	Secondary Education	**-0.005*****	0.0009556
H3. Tolerance/ Openness	Culture	**-0.033*****	0.0108462
	Foreigners	**0.268*****	0.0597044
	Social Inequality	**-0.125*****	0.0205913
H4. Technology	R&D Firms	**1.198***	0.6898952
Log-likelihood	-1566.4406		
Wald chi2(12) (joint significance of the variables in the model)	1228.17 [Prob > chi2 = 0.0000]		
Pseudo R^2	0.2592		
Nr. Observations	113,652		
Likelihood-ratio (LR)test – Unrestricted with all variables vs restricted (measure of fit for CLM specification)	$LR_{full/\ restricted}$ = 460.59 [Prob > chi2 = 0.0000]		

***, **, * one, five and ten percent significance levels, respectively.
Source: Authors' computations based on STATA 13 ® and micro-data from the Linked Employer-Employee Databases, GEE/ ME, Portugal (year 2009).

From this it is possible to conclude that the effects of traditional location factors - location and urbanization economies - support the empirical literature due to benefits arising from industry-specific (creative sectors) clustering, urban agglomeration and due to externalities transversal to all co-located firms/ industries, which validates our *Hypothesis 1* (*H1*) that agglomeration economies are positively related to creative firms' location choices.

Regarding human-capital estimates, it is noticeable that higher education at a regional level (*Higher Education*) plays a statistically highly significant and positive effect in creative firms' location decisions. A unit increase in this factor leads to a positive increment of 23% ($e^{0.206}$) on the odds of locating at a particular municipality versus all the other alternative locations. In turn, lower educational levels, such as upper

secondary schooling rate (*Secondary Education*), have a negative, statistically significant effect. These facts are in overall accordance with the empirical/ exploratory research on the location of creative industries (Florida, 2002, 2005; Florida et al., 2008; Lazzeretti et al., 2012), contrasting with results obtained by studies (e.g., Arauzo-Carod and Manjón-Antolín, 2004; Arauzo-Carod and Viladecans-Marsal, 2009; Liviano and Arauzo-Carod, 2012) on the location of medium-to-low technology manufacturing firms (cf. Table 4.2), which can be explained by the specific requirements that creative firms usually have of a highly skilled labour force. These findings validate the implications of *Hypothesis 2a.* that the region's higher education human capital is positively related to creative firms' location decisions.

Concerning tolerance-related variables (institutional factors), we observe a positive, significant impact of immigrant legalization rate (*Foreigners*), denoting openness to immigrants/ newcomers, in location decisions. These decisions are negatively affected by the existence of social inequalities (*Social Inequality*) in the municipality, which finds support in the empirical literature that tolerant/ open environments are a locus of creative activities (Florida et al., 2008). The coefficient for cultural amenities (*Culture*) is significant and negative, which can be due to the fact that museums, libraries and cultural facilities are spread across inland and coastal municipalities, and are much more related with heritage and historical sites than with the contemporary art facilities, usually found in large metropolises as mentioned by Florida (2002, 2005). Summing up, although cultural infrastructures repel creative firms, their location choices favour more tolerant and equal environments, where openness to newcomers and less social inequality are present. This evidence partially confirms *Hypothesis 3*.

Finally, the estimate for regional technological endowments (*R&D Firms*) shows a positive and significant coefficient, which corroborates the empirical literature (e.g., Autant-Bernard, 2006; Audretsch et al., 2007) that creative firms tend to favour municipalities where the stock of knowledge (developed by private firms) and the conditions for the innovative activity are higher. This confirms our *Hypothesis 4a*, that a region's technological endowments are positively related to creative firms' location choices.

Since human capital is not only an attribute of the region but also of the firm, in order to test *H2b.*, we estimate the baseline model for three groups of firms (cf. Table 4.6): firms with high educational levels (Model I), those with intermediate levels (Model II) and

ones with basic levels (Model III). Depending on the type of firm (with high, intermediate or basic educational level), the location determinants differ. This means that *Hypothesis 2b*, postulating that the human capital/ educational level existent in creative firms is related to their location choices, is validated.

Specifically, firms with higher educational levels tend to favour location determinants such as (co)location economies (*LQ Creative Firms*; *LQ Knowledge Firms*) and within-industry variety (*Creative Diversity*) in order to take advantage of complementary linkages; higher education/ graduate human capital (*Higher Education*) in opposition to lower educational levels; tolerant environments (positive significant effect of *Foreigners*; negative significant sign for *Social Inequality*), and local innovation (*R&D Firms*) in their location choices (cf. Table 4.6, Model I). These factors generally describe creative firms' location determinants in the empirical literature, and they are usually found in large urban centres (Florida et al., 2008; Lazzeretti et al., 2012).

In turn, creative establishments with intermediate and basic educational levels tend to privilege more industrial diversity and not clustering with complementary creative/ knowledge industries; human capital (*Higher Education*), particularly evident in the case of intermediate-level firms; and institutional factors (positive, significant effect of *Foreigners*; significant negative impact of *Social Inequality*) for both types of firms (cf. Table 4.6, Models II and III).

Creative firms with higher educational levels are most likely to portray intellectual property activities which require a highly skilled labour force, and they are usually co-located with other innovative/ knowledge-intensive firms (e.g., Advertising and Marketing; Software and Digital media; Research), whereas establishments with intermediate/ basic educational levels, more concerned with leisure, entertainment and artistic activities (e.g., Film, Video and Photography; Music/ Entertainment and Performing arts), mainly tend to privilege industrial and socially diversified environments.

Table 4. 6: Standard CLM estimates according to the educational level (high, intermediate, basic) in creative establishments (*n*=369; *j*=308 municipalities)

Location Determinants	Explanatory Variables	Standard CLM Estimated Coefficients		
		Model I - High educational level establishments	**Model II - Intermediate educational level establishments**	**Model III - Basic educational level establishments**
Agglomeration economies	Population Density	**0.0002**** (0.0000705)	**0.00001** (0.0001117)	**-0.00009** (0.0001497)
	LQ Creative Firms	**0.946**** (0.4927382)	**0.920** (0.6580498)	**1.831*** (0.7637896)
	LQ Service Firms	**-0.692** (0.5516932)	**-1.286*** (0.7615708)	**-0.034** (0.8838747)
	LQ Knowledge Firms	**0.903**** (0.3808698)	**0.584** (0.5456962)	**0.918** (0.6657408)
	Industrial Diversity	**0.096*** (0.0517234)	**0.180***** (0.0698426)	**0.239***** (0.0929636)
	Creative Diversity	**12.074***** (3.563947)	**10.376**** (4.731422)	**13.902**** (5.86167)
Human Capital	Higher Education	**0.231***** (0.0315043)	**0.247***** (0.0472813)	**0.028** (0.0687083)
	Secondary Education	**-0.005***** (0.0012599)	**-0.005***** (0.0018979)	**-0.002** (0.0024325)
Tolerance/ Openness	Culture	**-0.041***** (0.0143194)	**-0.014** (0.0228775)	**-0.041** (0.0276566)
	Foreigners	**0.178*** (0.093723)	**0.417***** (0.0991971)	**0.226*** (0.1333904)
	Social Inequality	**-0.084***** (0.0295553)	**-0.168***** (0.0381912)	**-0.176***** (0.0459044)
Technology	R&D Firms	**1.717*** (0.942001)	**-0.431** (1.467819)	**2.207*** (1.33419)
Nr. Observations / Cases		65,604 obs./ 213 cases	30,492 obs./ 99 cases	17,556 obs./ 57 cases

***, **, * one, five and ten percent significance levels, respectively. Standard Errors in brackets.
Source: Authors' computations based on STATA 13 ® and micro-data from the Linked Employer-Employee Databases, GEE/ ME, Portugal (year 2009).

Technology is also a characteristic of the industry sector to which a firm belongs. Thus, in order to test for the *Hypothesis 4b*, we estimate four models according to the technological intensity of the industry to which the creative establishment belongs: 'very high-tech' (Model I), 'high-tech' (Model II), 'medium-to-high tech' (Model III), and 'medium-tech' (Model IV) (cf. Table 4.7).

Table 4. 7: Standard CLM estimates according to technological intensity of creative firms (*n*=369; *j*=308 municipalities)

Location Determinants	Explanatory Variables	Standard CLM Estimated Coefficients			
		Model I – Very-High tech creative firms	**Model II - High-tech creative firms**	**Model III - Medium-High-tech creative firms**	**Model IV - Medium-tech creative firms**
Agglomeration economies	Population Density	**0.0001** (0.0000939)	**1.22e-06** (0.0000814)	**0.0003**** (0.0001481)	**0.0002** (0.0002621)
	LQ Creative Firms	**0.783** (0.6313214)	**1.341***** (0.5018942)	**0.149** (0.9689093)	**2.014** (1.500396)
	LQ Service Firms	**-0.396** (0.767213)	**-0.545** (0.5837014)	**-1.617*** (0.913261)	**0.200** (1.882107)
	LQ Knowledge Firms	**1.073**** (0.4863913)	**1.159***** (0.4017348)	**-1.563*** (0.8547248)	**0.897** (1.460686)
	Industrial Diversity	**0.2786***** (0.0933306)	**0.157***** (0.0581652)	**0.146*** (0.0847599)	**-0.052** (0.0784532)
	Creative Diversity	**10.057**** (4.575143)	**13.278***** (3.625556)	**5.233** (7.408923)	**24.362*** (12.0456)
Human Capital	Higher Education	**0.223***** (0.0422254)	**0.183***** (0.0366901)	**0.227***** (0.0639556)	**0.290**** (0.1453894)
	Secondary Education	**-0.007***** (0.0017053)	**-0.004***** (0.0013831)	**-0.00009** (0.0023451)	**-0.008** (0.0049457)
Tolerance/ Openness	Culture	**-0.036*** (0.0193225)	**-0.030*** (0.0162479)	**-0.013** (0.0294751)	**-0.075** (0.0474394)
	Foreigners	**0.316***** (0.1104592)	**0.275***** (0.0828753)	**0.359***** (0.1454878)	**-1.639** (1.343929)
	Social Inequality	**-0.129***** (0.0418044)	**-0.145***** (0.031077)	**-0.015** (0.0478961)	**-0.227***** (0.0859189)
Technology	R&D Firms	**1.251** (1.28737)	**0.616** (1.080231)	**1.965** (1.564127)	**4.829**** (2.397027)
Nr. Observations / Cases		37,576 obs./ 122 cases	54,208 obs./ 176 cases	15,400 obs./ 50 cases	6,468 obs./ 21 cases

***, **, * one, five and ten percent significance levels, respectively. Standard Errors in brackets. The division in terms of technology-intensity was made following the taxonomy of Silva and Teixeira (2011).
Source: Authors' computations based on STATA 13 ® and micro-data from the Linked Employer-Employee Databases, GEE/ ME, Portugal (year 2009).

In the case of very high and high-technology creative establishments, agglomeration economies due to the co-location with creative and knowledge-based firms (*LQ Creative Firms*; *LQ Knowledge Firms*); urbanization economies from related variety (*Industrial* and *Creative Diversity*); higher levels of human capital (*Higher Education*); and institutional factors of tolerance (*Foreigners*; *Social Inequality*) play important roles as location determinants. In the case of medium-to-high and medium-technology creative establishments, decisions are mainly affected by human capital (*Higher Education*) and institutional tolerance-related factors (*Foreigners*; *Social Inequality*). Moreover, these firms avoid or are indifferent to the co-location with creative/ knowledge-based activities, as shown by the sign and significance of *LQ Creative Firms* and *LQ Knowledge Firms* (cf. Table 4.7, Models III and IV). This provides evidence for different patterns of location behaviour according to the technology-level of creative firms, which validates our *Hypothesis 4b*.

Finally, in order to account for the inter-territorial spillovers of neighbouring municipalities in creative firms' location choices (*H5*), we estimate an 'enlarged' model, adding the spatial lags of each explanatory variable in the CLM (cf. Table 4.8).
It is evident from the estimates that when including the attributes of neighbouring regions, the most important determinants of creative firms' location choices remain much the same as in the standard CLM estimations (Table 4.5). The attributes of chosen locations have a significant effect on firms' decisions while those of nearby regions only show significance for the case of *Secondary Education_spl* and the institutional factor *Social Inequality_spl*. Here, it is possible that since upper secondary education is a variable which is widely distributed throughout the country, and social inequality is an institutional factor, their effects may extend beyond the boundaries of each municipality. In short, *Hypothesis* 5 (*H5*) is partially sustained by the data.
Although it is critical to account for inter-territorial spillovers, in the particular case of our database, location behaviour is strongly shaped by municipality characteristics and not by the aspects of contiguous regions. This can be understood in that creative firms are mainly located in large or important urban centres, with an ample supply of resources (e.g., human capital, knowledge networks and technological endowments), related variety and large consumer markets, with little need to resort to resources beyond the borders of their region.

Table 4. 8: CLM with spatially lagged variables - parameter estimates (*n*=369 cases/ creative establishments; *j*=308 alternatives/ municipalities)

Hypotheses	Variable/ Location Determinant	Estimated Coefficient	Standard Error
H1. Agglomeration (location and urbanization) economies	Population Density	**0.0002****	0.0001019
	LQ Creative Firms	**0.879****	0.4047041
	LQ Service Firms	**-0.147**	0.484064
	LQ Knowledge Firms	**0.785****	0.3524896
	Industrial Diversity	**0.068***	0.0400985
	Creative Diversity	**10.925*****	2.871029
H2. Human Capital	Higher Education	**0.165*****	0.0394276
	Secondary Education	**-0.00007**	0.0014653
H3. Tolerance/ Openness	Culture	**-0.033**	0.0219262
	Foreigners	**0.293****	0.1279316
	Social Inequality	**-0.063****	0.0313443
H4. Technology	R&D Firms	**2.194****	0.9108805
H5. Inter-territorial spillovers of neighbouring regions	Population Density_spl	**0.0003**	0.0002221
	LQ Creative firms_spl	**1.178**	1.017497
	LQ Service firms_spl	**-1.062**	0.7401107
	LQ Knowledge firms_spl	**-0.034**	0.7902569
	Industrial Diversity_spl	**0.028**	0.0544824
	Creative Diversity_spl	**10.645**	7.551003
	Higher Education_spl	**0.026**	0.0945354
	Secondary Education_spl	**0.005****	0.0025297
	Culture_spl	**-0.002**	0.0551487
	Foreigners_spl	**-0.009**	0.1638044
	Social Inequality_spl	**-0.067***	0.03949
	R&D Firms_spl	**-2.288**	1.622236
Log-likelihood	-1548.1567		
Wald chi2(24)	1229.31 [Prob > chi2 = 0.0000]		
Pseudo R^2	0.2678		
Nr. Observations	113,652		
Likelihood-ratio (LR) test	$LR_{\text{full/ restricted}} = 497.16$ [Prob > chi2 = 0.0000]		

***, **, * one, five and ten percent significance levels, respectively. Source: Authors' computations based on STATA 13 ® and micro-data from the Linked Employer-Employee Databases, GEE/ ME, Portugal (year 2009).

4.2. Empirical results by creative industry sector

The location patterns of creative industries reveal heterogeneous characteristics across creative sector groups (Cruz and Teixeira, 2014). Thus, it is expected that creative firms' location behaviour is differentiated according to the industry sector to which they belong.

Indeed, standard CLM estimates by sector (cf. Table 4.9) indicate that creative establishments/ start-ups are affected by different combinations of location factors, depending on their industry sector.

Creative firms in the sectors of 'Advertising and Marketing' and 'Software and Digital media' tend to favour regions with higher concentrations of creative and knowledge-based activities, benefiting from synergies of co-location with complementary industries and from industrial and creative diversification/ related variety; with higher human capital and tolerance/ openness, reflected by the foreigners' acceptance rate and lower levels of social inequality. These location factors, characterizing large urban centres (such as Lisbon and Oeiras), support the arguments usually raised in the empirical literature on creative industries (e.g., Florida, 2002, 2005; Florida et al., 2008; Lazzeretti et al., 2012; Cruz and Teixeira, 2014).

In turn, establishments that belong to 'Publishing', 'Architecture', 'Design' and 'Film, Video and Photography' industries, mostly located across intermediate or important urban centres in the North-Centre of the country, share some similarities in their major determinants, mostly related with industrial/ related diversity, institutional and human capital factors.

In the 'Publishing' industry, where firms are quite dispersed across intermediate urban centres in the country's North-Centre (around Porto, Coimbra and Lisbon), firms emphasise creative diversity, human capital and social equality as location determinants.

In the 'Design' sector, where firms are mainly located in Northern intermediate urban centres (around Porto), creative establishments tend to favour municipalities with industrial diversity, lower concentrations of services-based firms, higher levels of human capital and lower social inequalities. The clustering of services mainly occurs in inland/ coastal/ tourism municipalities, thus the negative estimate in Design (cf. Table 4.9) might be explained by design firms' preference to locate near relevant

manufacturing industries (e.g., fashion/ textiles design, furniture/ equipment design, industrial/ product design, graphic design), that are mostly located in the North of Portugal.

Concerning 'Architecture', creative establishments favour co-location with other creative activities, creative diversity/ related variety and higher levels of human capital. These firms tend to be located in intermediate urban centres in the North-Centre municipalities (mainly around Porto).

Firms belonging to 'Film, Video and Photography' prefer regions with lower social inequalities and higher levels of human capital. These firms are scattered all over the territory, with some prevalence around and in the two largest urban centres (Lisbon and Porto).

In the 'Research' sector, creative establishments prefer to locate where there are high levels of human capital (higher education) and avoid municipalities with lower levels of human capital (secondary education), mainly privileging cities with universities, higher-education institutions and research centres. In contrast, firms belonging to 'Music, Entertainment and the Performing arts' avoid locations with higher concentrations of knowledge-based activities and reveal a preference to locate in regions with larger consumer markets/ population density and higher openness/ immigration acceptance rate (mainly tourism/ coastal municipalities).

Table 4. 9: Standard CLM estimates according to the industry sector of creative firms (*n*=369; *j*=308 municipalities)

Location Determinants	Explanatory Variables	Standard CLM Estimated Coefficients							
		Advertising and Marketing	**Architecture**	**Design**	**Film, Video and Photography**	**Music/ Entertainment/ Performing Arts**	**Publishing**	**Software and Digital Media**	**Research**
Agglomeration economies	Population Density	**-0. 00007** (0.00001281)	**-0.0001** (0.0001833)	**0.0003** (0.0002055)	**0.0002** (0.0002027)	**0.0003**** (0.0001471)	**0.0001** (0.0002316)	**0.0001** (0.0000974)	**-0.0002** (0.0006399)
	LQ Creative Firms	**1.405**** (0.7455554)	**1.927*** (1.026236)	**1.878** (1.567831)	**0.336** (1.365024)	**0.268** (1.007442)	**1.633** (1.337802)	**0.586** (0.6696571)	**3.477** (2.947186)
	LQ Service Firms	**0.395** (0.9015368)	**-0.093** (1.103724)	**-3.404**** (1.644903)	**-0.732** (1.574931)	**-0.900** (0.9261011)	**-1.926** (1.606551)	**-0.278** (0.7970052)	**-0.609** (3.801012)
	LQ Knowledge Firms	**1.762***** (0.5980288)	**0.571** (0.9240992)	**0.278** (1.035118)	**1.213** (0.9725224)	**-1.731**** (0.9111739)	**0.640** (1.156567)	**1.345***** (0.4947524)	**-3.455** (2.882078)
	Industrial Diversity	**0.211**** (0.0994548)	**-0.003** (0.0827178)	**0.319**** (0.156575)	**0.247** (0.1678719)	**0.112** (0.0861024)	**0.017** (0.0793844)	**0.262***** (0.0975237)	**0.572** (0.4215791)
	Creative Diversity	**12.809**** (5.386207)	**14.604**** (7.267346)	**47.619** (37.15703)	**7.715** (9.880865)	**5.522** (7.670051)	**21.380**** (11.06376)	**8.486**** (4.822228)	**53.968** (83.35619)
Human Capital	Higher Education	**0.141**** (0.0588203)	**0.175**** (0.0707806)	**0.263***** (0.0976433)	**0.210**** (0.0986452)	**0.216***** (0.0654959)	**0.283***** (0.1083696)	**0.212***** (0.0447214)	**0.455**** (0.226402)
	Secondary Education	**-0.006***** (0.0022617)	**0.0002** (0.0026878)	**-0.005** (0.0032788)	**-0.008**** (0.003861)	**0.0002** (0.0024459)	**-0.006** (0.0040422)	**-0.006***** (0.0017459)	**-0.023*** (0.0130423)
Tolerance/ Openness	Culture	**-0.0288** (0.0246094)	**-0.0249** (0.0366109)	**0.026** (0.0712167)	**-0.029** (0.0387393)	**-0.020** (0.0308938)	**-0.051** (0.0413634)	**-0.039**** (0.0202847)	**0.139** (0.1634629)
	Foreigners	**0.337***** (0.1141239)	**0. 139** (0.1602713)	**0.404** (0.2596056)	**0.032** (0.3918062)	**0.318**** (0.1493572)	**-0.255** (0.6586536)	**0.317***** (0.111326)	**0.310** (0.9403586)
	Social Inequality	**-0.189***** (0.050074)	**-0.0736** (0.0620039)	**-0.143*** (0.0783756)	**-0.137*** (0.080603)	**-0.015** (0.0506231)	**-0.181***** (0.0651687)	**-0.114***** (0.0439651)	**-0.298** (0.2237966)
Technology	R&D Firms	**1.522** (1.571605)	**-0.199** (2.583797)	**-2.566** (3.234796)	**2.351** (2.298705)	**2.587** (1.598248)	**2.713** (2.136133)	**1.137** (1.362779)	**3.665** (4.794155)
Nr. Observations / Cases		24,024 obs./ 78 cases	12,320 obs./ 40 cases	8,932 obs./ 29 cases	8,624 obs./ 28 cases	13,860 obs./ 45 cases	8,316 obs./ 27 cases	33,880 obs./ 110 cases	3,696 obs./ 12 cases

***, **, * one, five and ten percent significance levels, respectively. Standard Errors in brackets. The sector of 'TV and Radio' had no observations in our database of 369 new creative establishments.

Source: Authors' computations based on STATA 13 ® and micro-data from the Linked Employer-Employee Databases, GEE/ ME, Portugal (year 2009).

5. Conclusions

This paper makes two contributions to the literature. First, we analyse the location behaviour of creative industries as a distinct group of industries, using highly detailed data at firm micro-level. Second, we study the role played by the location determinants according to creative firms' attributes, using a modelling framework from the perspective of the RUM-Discrete choice model approach in a context where the research on creative industries is still at an exploratory level.

Using a conditional logit model on the overall analysis of location determinants, with the particular advantage of allowing us to analyze location attributes and firms' characteristics, our findings suggest that creative firms, as a whole, share similarities in their location behaviour with other industries namely, the manufacturing sector. However, there are determinants that are specific to these firms and affect their location choices, most notably urbanization economies, human capital and tolerance/ institutional factors.

Similar to the results obtained on the study of manufacturing industry sectors (e.g., Arauzo-Carod and Viladecans-Marsal, 2009; Alamá-Sabater et al., 2011; Manjón-Antolín and Arauzo-Carod, 2011; Liviano and Arauzo-Carod, 2012), location economies are important factors driving creative firms' decisions. These firms tend to locate where other creative and knowledge-based activities are clustered in order to benefit from local input sharing (labour pool, infrastructures and suppliers), interdependencies and local networking. Such findings suggest that regional policies directed to promote the spatial clustering of creative businesses should take into account the importance of co-location with other related industries (namely, creative/ innovation/ knowledge-based activities) in the region.

We also found evidence on the particular role of urbanization economies, where creative firms favour proximity to urban environments and large consumer markets, as well as to related industries (industrial and creative diversity), corroborating previous exploratory studies (Florida, 2002, 2005; Florida et al., 2008; Lazzeretti et al., 2012). Concerning human capital, where effects are expected to be dependent on the industry sectors analyzed (cf. Section 2), our data proves that the role of human capital/ skilled labour is highly significant in creative firms' location decisions. Here, the region's

graduate human capital - contrary to lower levels of education - has positive and highly significant effects on firms' location choices. Also the human capital existent at the firm level is determining in its location choices. This is particularly explained by the demand for highly skilled labour. These requirements also explain why creative firms prefer to locate in tolerant/ open environments, favouring newcomers and social equality. A tolerant atmosphere allows for a higher accumulation of human capital and creative workers, complementary skills embodied in newcomers, and where artistic networks act as channels of information among firms/ industries.

Another finding is that R&D/ technological endowments also attract creative firms, given that technology provisions are a critical asset in promoting an environment where externalities arise in the form of tacit knowledge and encourage the creation of further knowledge and creative activities (Audretsch et al., 2007).

Thus, the more diversified, tolerant and innovative a region is the more favourable it will be for urbanization economies and a higher accumulation of human capital, which positively affect creative firms' location decisions, as proven in our findings. This causality should be acknowledged in terms of regional policy implications.

Another finding is that, despite the importance of inter-territorial spillovers (e.g., Autant-Bernard, 2006; Ellison et al., 2007; Alamá-Sabater et al., 2011), creative firms' location behaviour is strongly influenced by municipality characteristics and not by the aspects of contiguous regions. This may be due to the fact that creative firms prefer to locate in large urban centres with an ample resource supply and little need to resort to those beyond the borders of each region. This suggests that creativity-oriented policies may be more effective if they focus on the municipality level and on local regional determinants (e.g., local consumer markets, local networking, related variety, human capital, tolerance/ community safety, technology), since creative processes mainly happen at a localized level.

Finally, our findings show differentiated patterns of location behaviour according to the creative firm's educational level, its technology-intensity and the creative industry sector to which it belongs. This indicates that creative firms/ industries should be analyzed in accordance with their heterogeneity in location behaviours. Local policies for creativity and regional development should be designed according to the creative

industry sector and the attributes of creative firms' (e.g., knowledge-intensive sectors, such as 'Advertising/ Marketing' and 'Software/ Digital media'; research-based ('Research'); leisure-oriented ('Film, Video and Photography'/ 'Music/ Entertainment/ Performing arts'; functional/ related to the manufacturing sectors, in the cases of 'Architecture', 'Design' and 'Publishing'), in order to become more effective regional improvement tools.

Extending our scope to firms belonging to other industry sectors that could share (or not) some specificities of their location behaviour with creative firms would allow a comparative analysis with a better characterization of creative industries. Also, an extended analysis on the characteristics (e.g., sales, number employees/ size, employees' age) of creative firms should be helpful to bringing more information on the topic, given that location behaviour is affected by firms' attributes. In terms of methodology, the use of more recent data at micro-level and more robust estimation methods (nested logit, mixed logit) would provide a suitable, updated analysis of these firms' location choices and regional determinants, that would also add to the scope of this study.

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Appendix

The theoretical framework of our discrete choice model is based on the Random Utility Model (RUM) (McFadden, 1974; Carlton, 1983). Here, it is assumed that a firm/ plant i ($i = 1,\ldots, N$) chooses its location among a fixed set of J alternatives of location. Selecting a particular site $j = 1,\ldots, J$, each firm i obtains a profit of π_{ij}.

Profits are not observable, and the profit function, linear in the parameters, can be written as it follows:

$$\pi_{ij} = \boldsymbol{X}_j \beta + \boldsymbol{Z}_i \gamma + \boldsymbol{\varepsilon}_{ij} \quad \text{(A4.1)}$$

where $\boldsymbol{X}_j$ is a vector of alternative-specific regressors (attributes of choices), $\boldsymbol{Z}_i$ a vector of case-specific regressors (attributes of firms), and $\boldsymbol{\varepsilon}_{ij}$, a random disturbance.

Firm i chooses location j over location k if and only if:

$$\pi_{ij} \geq \pi_{ik}, \forall\, k \neq j,\ k = 1,\ldots, J \quad \text{(A4.2)}$$

Associated with the RUM theoretical approach is the Conditional Logit Model (CLM) (Carlton, 1983) that has been commonly applied as the econometric setting to estimate the coefficients and relevant parameters in the choice location behaviour of firms (Arauzo-Carod et al., 2010; Guimarães et al., 2004). The main advantage of the RUM-CLM is that it can be used as a theoretical framework and also be empirically applied to extensive databases at a micro level (Arauzo-Carod et al., 2010).

It is assumed that the disturbances $\boldsymbol{\varepsilon}_{ij}$, which represent the non-observed effects (firms' idiosyncrasies/ unobserved choice features), follow a Weibull distribution and are independent and identically distributed across firms and alternatives (McFadden, 1974). The probability that the firm i chooses alternative j is given by:

$$P_{ij} = \Pr(\pi_{ij} \geq \pi_{ik}, \forall\, k \neq j,\ k = 1,\ldots, J) \quad \text{(A4.3)}$$

In the case of the Conditional Logit Model (CLM),

$$P_{i\,j/k} = \frac{\exp\left(\boldsymbol{X}_{ij}\,\boldsymbol{\beta} + \boldsymbol{Z}_{\boldsymbol{i}}\,\boldsymbol{\gamma}_j\right)}{\sum_{\boldsymbol{k}=1}^{J} \exp\left(\boldsymbol{X}_{ik}\,\boldsymbol{\beta} + \boldsymbol{Z}_{\boldsymbol{i}}\,\boldsymbol{\gamma}_k\right)}\ , \text{ with } j = 1,\ldots, J \text{ alternatives} \quad \text{(A4.4)}$$

Given the general case of the standard CLM:

$$P_{il} = \frac{\exp\left(\boldsymbol{X}_{il}\,\boldsymbol{\beta}\right)}{\sum_{\boldsymbol{k}=1}^{J}\exp\left(\boldsymbol{X}_{ik}\,\boldsymbol{\beta}\right)} \quad \text{is the probability of choice of locating at location } l \tag{A4.5}$$

and

$$P_{im} = \frac{\exp\left(\boldsymbol{X}_{im}\,\boldsymbol{\beta}\right)}{\sum_{\boldsymbol{k}=1}^{J}\exp\left(\boldsymbol{X}_{ik}\,\boldsymbol{\beta}\right)} \quad \text{is the probability of choice of locating at location } m \tag{A4.6}$$

then, the ratio of the probabilities of locating at l versus m is given by:

$$\frac{\boldsymbol{P}_{il}}{\boldsymbol{P}_{im}} = \frac{\exp\left(\boldsymbol{X}_{il}\,\boldsymbol{\beta}\right)}{\exp\left(\boldsymbol{X}_{im}\,\boldsymbol{\beta}\right)} = exp[\,(X_{il} - X_{im})\,\boldsymbol{\beta}\,] \quad \forall\, l \neq m \tag{A4.7}$$

which reveals a uniform pattern of substitutability between location choices and depends on the characteristics of locations l and m. If the probability ratio between any two location alternatives is given by expression (A4.7), then that ratio equals to ***exp(β)*** when we consider a unit change, between alternatives, in the explanatory variable $\boldsymbol{X}$ (Scott Long and Freese, 2006).